THE VALIDITY OF THE DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION IN A SELECTED PRE-SCHOOL SAMPLE IN THE SOUTH AFRICAN CONTEXT

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Thesis presented in partial fulfilment of the requirements for the degree of Master of Arts (Counselling Psychology) at the University of Stellenbosch

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis consists of my own original work, and that I have not previously in its entirety, or in part, submitted it at any university for a degree.

It is a rule within the Department of Psychology that the report of research may take the form of an article which is ready for submission for publication to a scientific journal.

This research project is the equivalent to the prescribed thesis and is thus in accordance with the given requirements.

SUMMARY

Visual-motor integration is an important neuro-psychological aspect of school readiness. Developmental deficits in this area can have a detrimental influence on a child's ability to master reading, writing and arithmetic skills at school entrance level. Visual-motor integration problems should therefore be detected as early as possible to be able to implement intervention strategies which will promote visual-motor development. The study is socially relevant as it corresponds with the South African school policy which changed to a more integrative, inclusive approach after 1994.

The American standardised Beery Developmental Test for Visual-Motor Integration (VMI) is widely used as a screening technique for visual-motor abilities by psychologists, occupational therapists, educators and remedial teachers in South Africa. In order to determine the predictive validity of the American VMI for a group of South African subjects, the results of children on the VMI: 1989-norms and VMI: 1997-norms were compared to their results in the Copying Test of the Junior South African Individual Scales (JSAIS). Performance on these three tests were also compared with certain biographical variables as well as teacher ratings of specific academic skills. A representative sample of 238 pre-school children from the Stellenbosch region were selected.

According to the obtained results, a significant relationship was found between the results of the VMI: 1989 and VMI: 1997. The results of both the VMI: 1989 and VMI: 1997 correlated significantly with the results of the Copying Test. Performance in the tests correlated with chronological age, socio-economic status, as well as teacher ratings of specific academic skills. The discrepancy between the test performance of the three ethnic groups, suggests that the rate of the perceptual motor development described by the VMI developmental norms may be culture-specific.

Considering the overall results of this study, the interchangeability of the Copying Test and the VMI, especially the VMI: 1997, in clinical use is acceptable in the South African context. The Developmental Test of Visual-Motor Integration thus offers significant predictive validity, as well as a valid indication, of the visual-motor integration development in the sample of pre-schoolers used.

OPSOMMING

Visueel-motoriese integrasie is 'n essensiële neuro-sielkundige aspek van skoolgereedheid. Ontwikkelingsagterstande in hierdie area kan 'n kind se lees-, taal- en rekenkundige vermoëns nadelig beïnvloed. Probleme ten opsigte van visueel-motoriese integrasie behoort dus so vroeg as moontlik opgespoor te word sodat remediërende strategieë geïmplementeer kan word wat visueel-motoriese integrasie bevorder. Die navorsing is sosiaal relevant deurdat dit aansluit by die skoolbeleid wat sedert 1994 na 'n meer geïntegreerde, inklusiewe benadering met die akkomodasie van diversiteit, verander het.

Sielkundiges, arbeidsterapeute, opvoedkundiges en remediërende onderwysers in Suid-Afrika benut die Amerikaans gestandaardiseerde Beery-Ontwikkelingstoets vir Visueel-Motoriese Integrasie (VMI) op gereelde grondslag vir die evaluering van visueel-motoriese vaardighede. Ten einde die voorspellingsgeldigheid te bepaal van die Amerikaanse VMI vir 'n groep Suid-Afrikaanse toetslinge, is hul prestasies op die VMI: 1989-norms, sowel as die VMI: 1997-norms, met hul prestasies in die Natekentoets van die Junior Suid-Afrikaanse Individuele Skale (JSAIS) vergelyk. Prestasie in die toetse is ook met sekere biografiese veranderlikes, sowel as onderwyser-beoordelings van spesifieke akademiese vaardighede, vergelyk. 'n Verteenwoordigende steekproef van 238 voorskoolse kinders vanuit die Stellenbosch-omgewing is gekies.

Uit die resultate blyk daar 'n beduidende korrelasie tussen die VMI: 1989-resultate en die VMI: 1997-resultate te wees. Die resultate van beide die VMI: 1989 en VMI: 1997 het beduidend met dié van die Natekentoets gekorreleer. Prestasie in die toetse het met kronologiese ouderdom, sosio-ekonomiese status, asook onderwyser-beoordelings van spesifieke akademiese vaardighede, gekorreleer. Die VMI-prestasies van die drie etniese groepe het beduidend verskil en die gevolgtrekking kan gemaak word dat die VMI nie as 'n kultuurvrye toets beskou kan word nie. Die gevolgtrekking op grond van die resultate van die huidige studie blyk dat die VMI, en veral die VMI: 1997, beduidende voorspellingsgeldigheid by die voorskoolse ondersoekgroep gelewer het en as alternatief tot die Suid-Afrikaans gestandaardiseerde Natekentoets gebruik kan word.

ISISHWANKATHELO

Ukumanya ngokuhamba okubonakalayo kuyinto ebalulekileyo yokulungela ukungena esikolweni. Iintsilelo zenkqubela phambili kulo mba zinganefuthe elibonakalayo lobugcisa bokufunda emntwaneni, ukubhala nobuchule bezibalo kumgangatho wokungena esikolweni. Iingxaki zokumanya ngokuhamba okubonakalayo kufuneka ziqatshelwe kuselithuba khon'ukuze kwenziwe amalinge okungenela aya kuthi onyuse inkqubela phambili yokuhamba okubonakalayo.

I-Beery Development Test yokumanya ngokuhamba okubonakalayo (VMI) isetyenziswa ngokubanzi njengobugcisa bomkhusane wokuhamba okubonakalayo, ziinzululwazi zengqondo, iingcali zokunyanga, abefundisi-ntsapho, kwakunye neetitshala ezilungisayo eMzantsi Afrika, kodwa kusekho impikiswano yokuba olu vavanyo, lubekwe emgangathweni yiMelika, likhupha iziphumo ezizizo na kwilizwe leentlanga ezahlukeneyo njengoMzantsi Afrika. Ukuze kufunyanwe ukuba I-VMI ikhupha iziphumo ezizizo na kumalungu aseMzantsi Afrika, iziphumo zabantwana kwi-VMI: 1989 nakwi-VMI: 1997 zathelekiswa neziphumo zabo kwi South African Copying Test. Kuye kwakhethwa isampulu yabantwana abangama-238 abalungele ukungena esikolweni kwingingqi yaseStellenbosch.

Kuye kwafunyanwa unxulumano olubalulekileyo phakathi kweziphumo zeVMI: 1989 neze-VMI: 1997. Zozibini iziphumo ze-VMI: 1989 neze-VMI: 1997 ziye zanxulumana ngokubalulekileyo neziphumo ze-Copying Test. Indlela ekwenziwe ngayo iye yanxulumana nokulandelelana ngamaxesha obudala ngokunjalo novavanyo lukatitshala lobugcisa obuthile kwezemfundo. Umahluko wovavanyo phakathi kwendlela ekuqhutywe ngayo ziintlanga ezintathu, ucebisa ukuba isantya senkqubela phambili sendlela yokubona echazwe sisithethe senkqubela se-VMI sinokwayama kwimpucuko.

Nakubeni kunjalo, xa sicinga ngeziphumo zonke zesi sifundo, I-VMI inike uphawu lenkqubela phambili yokumanya ngokuhamba okubonakalayo kwisampulu yabantwana abasetyenzisiweyo abalungele ukungena esikolweni.

We are guilty of many errors and many faults, but our worst crime is abandoning the children, neglecting the fountain of life.
Many of the things we need can wait.
The child cannot.
Right now is the time his bones are being formed, his blood is being made and his senses are being developed.
To him we cannot answer "Tomorrow"
His name is "Today"...

- Gabriela Mistral -

To my parents

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CONTENTS

LIST OF TABLES

Page

1. INTRODUCTION

1.1 General Introduction

The Developmental Test for Visual-Motor Integration (VMI), or also known as the Beery (Beery, 1982, 1989, 1997), is widely used as a screening technique for visual-motor abilities by psychologists, occupational therapists, educators and remedial teachers in South Africa; there is, however, still controversy about whether this American standardised test offers valid results for a multi-ethnic society like South Africa (Beery, 1982; Brand & Le Roux, 1991; Helm, 1989; Schlodder, 1986; Tennant, 1986).

The VMI was specifically designed for pre-school and early school-age children (Nuttal, Romero & Kalesnik, 1992); has a relatively structured nature; has high inter-scorer reliability even when training in the use of the test has been minimal; could be regarded as relatively 'culture*-fair' due to the non-verbal nature of the test-items, as well as the fact that it also can be administered individually or as a group test and thus lends itself to widespread use as a regular classroom screening instrument (Schlodder, 1986; Schoeman, 1995).

The primary aim of the study was to determine the validity of the American VMI (Beery, 1989, 1997) in a multi-ethnic South African context. The secondary aim of the study was to determine the relation between the results of the VMI: 1989, VMI: 1997, the Copying Test and certain biographical variables of the testees. As South Africa consists of many various population groups, the multi-ethnic population for this particular study is defined as white, coloured and black people, living in the Western Cape. As the VMI has high validity and reliability and is relatively simple and quick to administer (Palisano & Dichter, 1989; Preda, 1997; Vorster, 1994), determining whether this American standardised test offers valid results for a group of South African subjects, could enhance the detection of visual-motor integration problems. With this knowledge, intervention programmes could be implemented much sooner - Gredler (2000) emphasises the importance of early childhood education, assessment and intervention. Although the process of figure-copying should be relatively culture-free, it is possible that different

* For the purpose of this study, the term "culture" is used interchangeably with "ethnicity".

results in South African situations might emerge - empirical validation of this test in South Africa is therefore essential.

In 1994 a similar study was done by Vorster using the VMI (Beery, 1982, 1989) and the South African Copying Test, a subtest of the Junior South African Individual Scales (Madge, 1981a); during which several recommendations were made – this proposed follow-up study aims to incorporate those recommendations. As Vorster (1994) found a significant relationship between the results of the VMI: 1982 and the VMI: 1989, only the latest edition of the VMI (Beery, 1997) as well as the VMI: 1989 (Beery, 1989) will be used. According to the researcher's findings, the norms of the VMI: 1997 have never been used in a South African context. Vorster (1994) also recommended that future studies should include children from all cultural groups in South Africa.

The study is socially relevant as the South African school policy changed after 1994. The school policy changed to a more integrative approach and according to the National Education Policy Act, 1996 (No. 27 of 1996) and section 5(4) of the South African Schools Act, 1996 (No. 84 of 1996), the statistical age norm per grade from January 2000 is the grade number plus 6 (Government Gazette, 1998). A learner must therefore be admitted to grade one if he* turns 7 in the course of that calendar year. Nuttal, Romero and Kalesnik (1992) state that a concern for the quality of education for all children has drawn national attention and the proposed study adds to this statement by emphasising the need for early school assessment as well as the importance of school readiness. Richter, Griesel and Rose (1994) add that there is an acute shortage in South Africa of standardised tests appropriate for the assessment of black children.

1.2 Defining Key Constructs

1.2.1 Pre-school children

For the purpose of this study there will be referred to pre-school children as children between 5 and 7 years old, who have attended a pre-school, day care setting or grade R in the Stellenbosch region. The developmental stage from 2 to 6 years is called early

* The masculine form of pronouns refers throughout to both sexes.

childhood (also referred to as the pre-school period) (Louw, Van Ede & Louw, 1998). Several researchers agree that during this stage considerable cognitive and physical-motor development occurs and certain developmental tasks must be successfully completed – fine and gross motor skills have to be refined, memory and metacognition must be developed; emotional control has to be attained; language and communication skills have to be expanded; the self-concept has to be clearly defined in order for school readiness to be achieved (Bigner, 1983; Newman & Newman, 1995; Van Ede & Louw, 1998). According to Erikson's psychosocial theory of development, these children are in the developmental stage of Initiative versus Guilt (Bukatho & Daehler, 1995; Erikson, 1963). During this stage, children start to make plans, set goals, and persist in both physical and social exchanges. Even though frustration is inevitable, the child's goal is to remain enthusiastic and bold and to gain a sense of purpose. Caldwell (cited in Janse van Rensburg, 1992) emphasises that these earliest years of life are of crucial importance and that these are the years during which the basis for a major part of a person's intellectual, socio-emotional and normative development is laid.

1.2.2 **Visual-motor integration**

Frostig and Horne (cited in De Villiers, 1989) isolate five visual-perceptual abilities which seem to have the greatest relevance to academic development. Perception of position in space and spatial relationships (which can be jointly defined under the concept of visual-spatial ability); perceptual constancy; visual-motor integration and figure-ground perception. Visual-spatial perception can be defined as the ability of an observer to perceive the position of two or more objects in relation to himself and in relation to each other (De Villiers, 1989). Another closely related term, perceptual-motor ability, can be defined as including input with regard to sensory and perceptual abilities and output with regard to motor or muscular activities. During perceptual-motor impairment, the integration between perception and motor movement patterns is disrupted (Van Zijl, 1985). It seems therefore, that both terms visual-motor and perceptual-motor, refer to the same construct. For the purpose of this study and to avoid confusion, the focus will remain only on visual-motor integration.

Beery (1997) defines visual-motor integration as the degree to which visual perception and finger-hand movements are well co-ordinated. He adds that the VMI (Beery, 1967, 1982, 1989, 1997) is designed to measure the hyphen in the term visual-motor integration on the premise that a whole can be greater than the sum of its parts, and the parts may function well independently, but not in combination. According to Baard (1998) visual-motor integration is the performance of fine perceptual-motor tasks that involve the co-ordination of specific visual input with a specific motor response drawing, e.g. viewing a geometric figure and drawing a copy of it. The fine motor skills involved predominantly the use of the hand and fingers to produce precision movements, and specifically rely on eye-hand co-ordination for successful task accomplishment. Tennant (1986) stipulates that visual-motor integration is a composite of behaviours involving, among others, visual perception and motor co-ordination. It involves the effective working together of the eyes and muscles of the body. According to Aylward and Schmidt (1986), visual-motor integration is the child's ability to integrate visual-perceptual skills with fine motor co-ordination.

1.2.3 **Validity**

A traditional definition of validity is the extent to which a test measures what it was designed to measure (Aiken, 1971; Anastasi, 1982). The validity of a test is determined by correlating the test scores with another variable of interest (Graham & Lilly, 1984). There are three types of validity or validation procedures, but for the purpose of this investigation, the focus will be on criterion-related validity, more specifically predictive validity. Criterion-related validity is a quantitative procedure which involves the calculation of a correlation coefficient between a predictor, or more than one predictor, and a criterion (Foxcroft & Roodt, 2001). Thus it can be defined as the accuracy with which criterion scores can be predicted by means of test scores. There are two types of criterion-related validity: concurrent validity and predictive validity (Carmines & Zeller, 1979; Owen & Taljaard, 1995). According to Guion (Smit, 1991), predictive validity is the extent to which variance in a test (predictor variable) is relevant to the variance in the subsequent criterion measures.

Validity will be determined by data which were generated by primarily three methods. Firstly, the biographical questionnaires completed by the parents. Variables regarding parental background such as marital status, socio-economic status, careers of both parents and qualifications of both parents are used. Variables regarding the children's developmental background such as chronological age, gender, ethnicity, birth history, history of illnesses with neurological implications, as well as, accidents causing head or back injuries, are used. Secondly, the rating by the class teachers also add six variables. These variables are scholastic skills which consist of school readiness, reading ability, arithmetic ability, writing ability, fine motor skills and ability to concentrate. Lastly, the variables from the psychometric assessment consist of the scores obtained on the two editions of the Beery Developmental Test of Visual-Motor Integration and the Copying Test.

1.3 **Literature Review**

The term 'visual-motor integration' was introduced and conceptually developed by Keith E. Beery in 1967 when the Beery-Buktenica Developmental Test of Visual-Motor Integration was first published (Beery, 1967a, 1967b; Beery & Buktenica, 1967). Visual-motor integration plays an important role in the development of a child. The reason for this being that intact perceptual modalities are a prerequisite for advancement with formal learning activities (Brand, 1991; Graf & Hinton, 1997; Karapetsas & Vlachos, 1997; Venter, 1985; Vorster, 1994). According to several researchers, visual-motor integration has a definite influence on a child's ability to master reading, writing and arithmetic skills at school entrance level (De Jager, 1982; Hanekom, 1991; Hanekom & Robinson, 1991; Vorster & Brand, 1995). Deficits in visual-motor integration in the pre-school years have often been cited as precursors of later learning disabilities (Sats & Friel, 1974). McGrath and Sullivan (1999) contribute by emphasising this skill's importance, as a transient immaturity in visual-motor integration skills may delay the acquisition of pre-school letter recognition, consequently the child's transactions with his environment are affected long after the motor immaturity has reached age-appropriate norms. Hanekom (1991) views visual-motor integration as an important part of school readiness.

Lehman and Breen (1982), Laszlo and Bairstow (1985), as well as Chan (2000), state that interference with visual-motor abilities can restrict interaction with the environment and can have far-reaching consequences for the child's physical and psychological well-being. The visual-motor integration construct also implies that individuals with educational, psychological and/or medical difficulties may have, on average, more difficulty with integration than their peers (Beery, 1997). Visual-motor integration problems should therefore be detected as early as possible to be able to implement intervention strategies which will promote visual-motor development. The question remains, however, whether these problems could be alleviated effectively. Van Zyl (cited in Louw, Van Ede & Louw, 1998) worked with a group of 5 to 6-year old Afrikaans-speaking children who were a year or more behind in perceptual-motor development. Van Zyl developed a program which was based primarily on children's play to enhance their perceptual-motor abilities over a period of six weeks. The results showed improvements in their perceptual-motor skills. A study done by De Wet, Falkson, Richter and Griesel (1989) confirmed that the performance of a group of black children (with a mean chronological age of 6 years), who attended a program designed to enhance motor and visual-perceptual abilities, improved significantly. If early identification of visual-motor impairment is possible, a program can be implemented to equip children for a better start with formal school training. It therefore seems that timely professional intervention can have positive effects and thus have the potential to be more cost-effective in reducing the overall incidence of scholastic problems and their cost to the community.

1.3.1 **The Beery Developmental Test of Visual-Motor Integration**

A test commonly applied to children for the assessment of visual-motor integration, is the VMI (Beery, 1982, 1989, 1997). According to several experts, the VMI has high validity and reliability; is relatively simple and quick to administer; is inexpensive; it includes a special form sheet for use by the testee, allowing for a compact record of the testee's performance with no loss of qualitative data in the process; and is easily portable (Fadely & Hosler, 1980; Leonard, 1986; Palisano & Dichter, 1989; Preda, 1997; Siewert & Breen, 1983; Tennant, 1986; Vorster, 1994).

This test specifially measures fine motor co-ordination and visual perception of abstract stimuli, but does not measure psychomotor speed (Graf & Hinton, 1997). As the VMI consists of a series of shapes which progress from simple figures to more complex ones, the score on this test reflects the examinees' developmental level of visual-motor ability (Demsky, Carone, Burns & Sellers, 2000). In concurrent validity studies, the test has been shown to correlate significantly with scores on the Bender Gestalt test, another popular measure of visual-motor integration (Aylward & Schmidt, 1986; Porter & Binder, 1981; Spirito, 1980; Tolor & Brannigan, 1980). Lehman and Breen (1982), as well as Armstrong and Knopff (1982), however, found a lack of comparability between the Bender Gestalt test and the VMI. There appears to be contradicting research regarding this topic. Recent research with the VMI has shown that this instrument can be used in conjunction with other measures to gain valuable insights into a child's neuropsychological functioning. Parush, Yochman, Cohen and Gershon (1998) reported that clumsy children scored significantly lower on the VMI than a control group. As the VMI is often used for the evaluation of perceptual function in adult brain injured patients, Concha (1989) examined the relationship of score to age and score to diagnosis, and provided adequate information on the validity of the test as a measure of age-related changes as well as visual-perceptual motor problems in the adult stroke patient. She concluded that the VMI is also a reasonably valid and reliable method for measuring perceptual functions of the adult.

- **Validity**

For the purpose of this study, the focus will be on criterion-related validity, more specifically predictive validity. According to Beery (1989, 1997) researchers have found the VMI to be a valuable predictor when used in combination with other measures. Comparison of a battery of pre-school test scores with the same children's achievement at the end of pre-school and at the end of first grade, indicated that the VMI, in combination with a test of auditory-vocal association, best predicted achievement (Beery, 1997). Fletcher and Satz (cited in Beery, 1997) found that the inclusion of the VMI with three other brief tests correctly predicted 85% of pre-school children who were problem readers seven years later. VMI-results, particularly when coupled with pediatricians' ratings, have been significantly predictive of school grade failures, or retentions (Beery,

1997). The VMI has sufficient validity to measure changes in visual-perceptual ability associated with increases in chronological age (Brand & Le Roux, 1991; Vorster, 1994).

- **Reliability**

The reliability of tests such as the VMI requires that there be adequate consistency in the content of its items, individuals' performances when the test is readministered and scoring performed by different examiners. According to Beery (1997) the odd-even correlations ranged from 0,76 to 0,91 with a mean value of 0,85, in the 1988 VMI-norming studies. During the 1996 VMI-norming studies the correlation was 0,88. Due to the consistency of the VMI and the fact that the four-point scoring used in the VMI: 1989 correlates almost perfectly, 0,98, with the usual VMI one-point scoring, VMI studies conducted prior to the 1996 norming can be validly reported and compared. The overall test-retest raw score coefficients are 0,87 for the VMI: 1997 and 0,81 for the VMI: 1989 (Beery, 1989, 1997). The interscorer reliabilities are 0,94 for the VMI: 1997 and 0,93 for the VMI: 1989 (Beery, 1997). However, Pryzwansky (cited in Beery, 1997) report that the level of interscorer reliability, particularly for inexperienced scorers, seems to depend on the preparation of the scorers.

Leonard (1986) concluded that the reliability and validity of the VMI compares well with other instruments of visual-motor ability.

- **Chronological Age**

The VMI was designed to measure visual-motor integration and to reflect developmental age differences in that arena (Beery, 1989). Thus, the VMI significantly correlates with chronological age ($r = 0,89$). This view is in line with the findings of Vorster (1994). Beery (1997) also found in 1996 that the correlation between chronological age and the VMI: 1997 is 0,83 ($p<0,01$).

- **Gender**

According to Tennant (1986) gender was, until recently, thought to affect most visual-motor skills. Most tests of visual-motor skills have separate norms for males and females. However, Aylward and Schmidt (1986), Weil and Cunningham-Amundson (1994), as well as Williams (1983), found no gender differences for the development of visual-motor integration. Ruffer (1984) found that arm-hand steadiness was sex-dependent, with girls scoring better than boys, whereas reaction time was faster for boys

than for girls. However, Beery (1982) found no significant differences in performance on the VMI between girls and boys and the Revised VMI manuals (1989 and 1997) provide combined norms for girls and boys. Baard (1998) and Vorster (1994) concluded that the effect of gender on visual-motor development is a subject of disagreement among researchers.

- **Ethnicity**

Beery (1982, p 8) described the test as being "relatively culture independent" and stated that separate norms were not felt to be warranted for different ethnic groups. He reported statistically significant differences in VMI-test performance between black, caucasian, latino and other ethnic backgrounds, but found that most of the variance was due to chronological age, with only 1% attributable to ethnic background. According to Schlodder (1986) and Tennant (1986) cultural background has a very small influence on the test scores, but should be taken into account when interpreting the test performance. Skolimowska (1978), however, administered the Bender Gestalt test and the VMI to 90 coloured South African children, aged 6 to 10 years, and it was concluded that the Bender Gestalt test-norms appeared to be more valid than the VMI-norms for the specific group. In another South African study, Helm (1989) applied the VMI and the Developmental Test of Visual Perception of Frostig on 530 black, urban children and concluded that both tests are unappropriate for the assessment of black, urban children. Helm and Concha (1990) concluded that the diagnostic and prognostic relevance of the VMI for other ethnic groups must be questioned. However, they also added that the use of the test instructions in Sotho, Xhosa and Zulu, as well as the use of percentile rankings for every age group, might increase the validity of the test for the South African urban black population. Brand and Le Roux (1991) reported on research where the VMI was administered to 62 South African pre-school children. They concluded that especially the first four items did not discriminate efficiently between the testees. Mao, Li and Lo (1999) concluded that it is necessary to examine the construct of the VMI test and the sequence of the item difficulty before applying its results to children from different cultural backgrounds. Most researchers urged further investigation and stipulated the importance of recognising the cultural varieties of childhood in South Africa which may be reflected in the results of the proposed study.

- **Socio-Economic Status (SES)**

Baard (1998) supports research that has identified visual-motor integration as a particularly sensitive predictor of socio-economic status. It is during the early childhood years that environmental deprivation could have the most disastrous effects. Janse van Rensburg (1992) concluded that there appears to be agreement among several researchers that the VMI is sensitive as a predictor of the achievement of lower socio-economic groups.

1.3.2 The Copying Test

Another test frequently used in South Africa for evaluating visual-motor integration is the Copying Test, a subtest of the Junior South African Individual Scales (JSAIS), which has been standardised for South African children. The JSAIS was developed in 1981 with the main aim of the test battery twofold in nature, namely to establish the general intellectual level of children between ages of 3 years 0 months and just under 8 years, and to evaluate a child's relatively strong and weak points in some significant facets of intelligence (Madge, 1981a). The use of some of the tests in the battery permits a tester to evaluate certain non-cognitive behaviours including concentration, perseverence, willingness to work, hyperactivity, impulsivity and distractability (Madge, 1981a). According to Heimes (1983), the JSAIS may be described as a norm-reference test as the individual's performance is evaluated in relation to the performance of other individuals on the same test. During standardisation a battery of 20 tests was constructed for item analysis. For the purpose of item analysis it was essential to test more or less equal numbers of children in the two language groups – Afrikaans and English – and equal proportions of boys and girls (Madge, 1981a).

- **Validity**

Several researchers agree that each test of the JSAIS has content validity as it has a satisfactory degree of relevance to the property being measured (Madge, 1981a; Roger, 1989; Wade, 1989). Concurrent validity has been assessed with respect to the ratings of teachers/psychologists on language abilities and level of general intelligence. All correlations between scaled scores and the rating on general intelligence were significant ($p<0,01$) with the average correlation varying from 0,55 for the Global IQ Scale to 0,42

for the Memory Scale (Madge, 1981a). Although it seems that there is no information available on the predictive validity of the JSAIS, Madge (1981a) is of the opinion that the primary criterion to be predicted with the Global Intelligence Quotient-score is future scholastic achievement and that the individual tests and scales should be useful for predicting the possibility of specific kinds of learning problems.

- **Reliability**

To establish the degree of reliability, the Kuder-Richardson Formula Eight, as well as standard errors of measurement for each test were calculated and indicated a mildly positive relationship of more than 0,80 (Madge, 1981a). The intellectual tasks of the JSAIS have been divided into 22 relatively homogeneous groups. Each group of items possesses sufficient specificity to justify the use of each test on its own. The Copying Test may therefore be used on its own to measure perceptual and visual-motor integration (Madge, 1981a). The average reliability coefficient across all ages of the Verbal Intelligence Quotient is 0,90; the Performance Intelligence Quotient is 0,93 and the General Intelligence Quotient is 0,97. Madge (1981a) agrees with Wechsler's finding that, from about three years onwards and at intervals varying from one month to two years, the average difference in test-retest IQ's for most children is about five to seven points.

According to several experts, the Copying Test is a reliable and valid measuring instrument, especially to measure visual-motor integration (Brand, 1991; Hanekom, 1991; Leonard, 1986; Robinson & Boshoff, 1990; Vorster, 1994). Madge (1981a), Robinson and Boshoff (1990), as well as Roger (1989), contribute to this statement by stipulating that all the subtests of the JSAIS have content validity, construct validity as well as criterion-related validity. A correlational study with the JSAIS and the Griffiths Scales of Mental Development provided additional proof of the construct validity of the JSAIS (Foxcroft & Roodt, 2001).

- **Chronological Age**

There are a number of studies on the use of South African individual intelligence tests in different contexts. Robinson and Hanekom (cited in Foxcroft & Roodt, 2001) found that the JSAIS is valid for the evaluation of school readiness at the stage of school entrance.

Weschler (cited in Madge, 1981a) points out that scores in this type of test also positively correlate (in their particular ages) with scores in other measures of intelligence. He is of the opinion that the correctness of a response depends primarily upon perceptual and visual-motor organization, the development of which is closely tied to increasing chronological age. Luiz and Heimes (1988) compared the Griffiths Scales of Mental Development with the JSAIS. Their sample consisted of white children with mean age 4,3 years. The researchers found high to moderate correlations between the two scales and concluded that these scales complement one another and that they could be used to identify problems in young children. Vorster (1994) also found a significant correlation between chronological age and scores obtained on the Copying Test. It therefore seems that performance on the Copying Test and chronological age correlate.

- **Gender**

Leonard (1986) compared scores on the Motor-Free Visual Perception Test with scores on the VMI, the Copying Test and four subtests of the Reitan-Indiana Neuropsychological Test Battery. She reported no significant differences in the relationship between performance and gender. Vorster (1994) confirms these findings.

- **Ethnicity**

The JSAIS has been standardised for different population groups and separate norms have been developed for each group, for example - for Indian children (Landman, 1988) and for coloured children (Robinson, 1989). This is essential as more than just language alone should be considered when determining cross-cultural validity.

- **Socio-Economic Status (SES)**

Leonard (1986) and Vorster (1994) reported no significant differences in the relationship between performance on the Copying Test and SES.

Other research indicates that Robinson (1986) determined a characteristic pattern of JSAIS scores for learning-disabled children with reading problems that distinguishes them from "normal" children. Wade (1989) also states that by utilising the factor scores derived in his study, the JSAIS and the Reitan-Indiana Neuropsychological Test Battery can be used together in a neuropsychological framework for assessment. Madge (1981a) adds that a good performance in the copying of figures is significantly related to scholastic achievement.

1.4 Theoretical Context

There are two major determinants of development, genetic and environmental, and in combination these determinants lead to great individual differences at all ages. The General Systems Theory emphasises the impact of the environment, from micro to macro social levels, on the child's development, as well as the interrelationships between the different systems which impact on the child (Bronfenbrenner, 1977, 1979; Ford & Lerner, 1992; Meyer, Loxton & Boulter, 1997). Von Bertalanffy (1968) also stated that the General Systems Theory is a general science of 'wholeness'. According to Louw, Van Ede and Louw (1998), the environments in which pre-schoolers grow up determine their school readiness to a great extent. Janse van Rensburg (1992), as well as Liddell and McConville (1994), indicate that in some of the black communities in South Africa, the environments do not prepare pre-schoolers adequately for school. Therefore, in applying this theory to the developing child in South Africa, the need to account for the wide range of systems that impact on the child, is realised.

The statement that development occurs through maturation, which is genetically determined, is one expounded by Jean Piaget (1952). Piaget regards cognitive development as the result of an individual's interaction with the environment. According to him, cognitive development is the outcome of the constant interaction between maturation, experience and practice, social interaction and transmission, and equilibration (Louw, Van Ede & Louw, 1998). Piaget and Inhelder (cited in Louw, Van Ede & Louw, 1998) state that heredity sets a programme for the maturation of the nervous and endocrine systems. Although there are individual differences, the maturation programme is a characteristic of the entire human race. At a predetermined stage in the individual's life, these systems reach a certain maturation level that enables the individual to function in a specific way.

The second approach stresses that there is an interaction between learning and maturation, a view strongly supported by Kephart (1971). According to Kephart (1971), all learning stems from motor functioning, which is necessary for the development of perception and essential for the development of cognitive skills. Thus, poor motor co-ordination prevents the acquisition of experience necessary for the development of cognitive skills. Kephart states that a child must be aided to establish "motor

generalizations" which include posture and balance, locomotion, contact as well as receipt and propulsion (Cratty, 1979). Perceptual-motor theorists Laszlo and Bairstow (1985) acknowledged Kephart's research by viewing the theory as a conceptual framework on interrelated motor, perceptual and more broadly cognitive factors. As Laszlo and Bairstow's (1985) perceptual-motor theory is more process orientated, the essence of underlying processes concerning perceptual-motor development is emphasised.

> While basic changes in the architecture of the central nervous system are genetically determined, there is no doubt that subtle changes and remodelling are induced by the experiences we have in interacting with our environment and the realisation of potential is strongly influenced by such experiences. (Laszlo & Bairstow, 1985, p 55)

Laszlo and Bairstow (1985) also state that humans are not passive receivers of sensoric imput, but are actively and intentionally engaged in directing eye and limb movements in a visual, tactile and kinaesthetic exploration of the environment. Therefore cognitive control over the perceptual processes can be exercised. By discussing these four theories, it was emphasised that visual-motor integration consists of a range of functions determined by a variety of factors like genetics and environment.

2. METHOD

2.1 Participants

The aim was to select a proportionally representative sample of approximately 280 children in the Stellenbosch region from the population of children between 4 years 9 months and 7 years who have attended a pre-school, day care setting or grade R for at least 3 months prior to the intervention. The participants were randomly selected with the co-operation of the Stellenbosch School Clinic. The following served as exclusion criteria: children who did not receive written parental consent for participation; children without normal visual acuity; children with neurological dysfunctions according to the teachers' observation; as well as children who had undergone an occupational therapy evaluation or school readiness assessment three months prior to the intervention.

Any known pathology; developmental disorder; as well as extremes regarding mental age, such as mental retardation, were also regarded as exclusion criteria. Any known psycho-social trauma such as recent divorce, separation or remarriage of the parents, as well as recent hospitalisation, were also taken into consideration; because, according to Louw, Van Ede and Louw (1998), these are potentially stressful situations that may have a psychological impact on the pre-school child. After applying the exclusion criteria, 238 children could participate in the study.

The 238 participants consisted of 127 (53%) boys and 111 (47%) girls. Their ages ranged between 4 years 9 months and 7 years 0 months, with a mean chronological age of 5 years 10 months. The sample consisted of white (n=66), black (n=71) and coloured (n=101) children. Language preferences were Afrikaans (n=112); English (n=24); both Afrikaans and English (n=32); Xhosa (n=66) and other languages not included in these categories (n=4).

Correct classification according to socio-economic status (SES) across the three ethnic groups required arriving at a valid operational definition of SES for the South African population. A composite index derived by Riordan (in Tennant, 1986) was used (See Addendum A). Riordan utilised two variables, namely occupation (of father/guardian) and educational level (of father/guardian). A numerical classification of the breadwinner's education was also proposed. The total score derived from the occupation and education of the father/guardian, which could range from 2-16, provides the socio-economic index for the subject. According to Riordan's index, the sample used in this study consisted of upper (n=86), middle (n=58) and lower (n=25) socio-economic families.

2.2 **Measuring Instruments**

Data were generated by primarily three methods. Firstly, the biographical questionnaires completed by the parents and the rating by the class teachers. Secondly, for optometrical screening the Ffooks Symbols Test and the Randot Stereotest were used. Lastly, the psychometric assessment consisted of the Beery Developmental Test of Visual-Motor Integration and the Copying Test.

A brief discussion of each method follows.

2.2.1 **Parents : biographical questionnaire**

This questionnaire (See Addenda G: English version, H: Afrikaans version and I: Xhosa version) is based on research done by Vorster (1994). Data regarding gender, chronological age in months, marital status of parent/guardian, educational level of parents as well as their careers, testees' developmental and medical history and the judging of the parent regarding the testees' level of school readiness, were generated in this way.

2.2.2 **Rating by the teacher**

As far as development of scholastic skills were concerned, teachers evaluated children from their own classes. A Lickert type scale (See Addendum J) with scale points between 1 and 7 was used for this purpose. The teachers judged the testees' level of school readiness, ability to learn to read and do arithmetic, their fine motor activities, concentration capabilities, as well as ability to learn to write.

2.2.3 **The Ffooks Symbols Test and The Randot Stereotest**

The child's abilities to judge depth, distance and to distinguish an object from its surrounding background are primary contributors to the perceptual information needed for successful motor performance (Baard, 1998). More detail about visual perception is thus needed before visual-motor integration can be tested and will be provided by The Ffooks Symbols Test (Clement Clarke International, not dated) and The Randot Stereotest (Stereo Optical Company, 1988), both used frequently by optometrists as screening devices.

The Ffooks Symbols Test was developed in London and is used as a screening device for the evaluation of children's visual capabilities. It consists of a card with printed shapes (e.g. a circle or a triangle) as well as a book with these shapes in varying sizes. The testee will be sitting approximately 6 metres from the tester with the book on his lap. The tester will point to a shape on the card and while one eye is closed, the testee must be able to point out the corresponding shape in the book.

When a testee is able to correctly identify the smallest shapes, he is able to see from a distance of 6 metres what he is supposed to be seeing. If he cannot distinguish all the shapes, the testee can, for example, see from 6 metres what other children can distinguish from 9 metres. However, it is essential for the researcher to bear in mind that according to Louw, Van Ede and Louw (1998), the visual and focusing abilities improve noticeably during the pre-school years, but visual acuity at the age of six is still not 6/6, but 6/9 on average.

The Randot Stereotest was developed in America and is used as a screening device for the evaluation of children's stereopsis – the ability to binocularly discern a difference in the distance from the observer of two objects (Marr, 1982; Stereo Optical Company, 1988). It consists of a card with varying figures (e.g. circles and animals), which is looked at through a special pair of glasses. By using the glasses additional dimensions are added to the card and some of the figures will appear three-dimensional which the testee must be able to point out. Both tests were explained to the researcher by an optometrist who also provided the tests during the data collection.

2.2.4 The Beery Developmental Test of Visual-Motor Integration

The VMI is a series of 24 geometric forms to be copied with pencil and paper. The forms are compiled in a booklet and arranged in increasing complexity. Each page contains three designs which have to be drawn below the corresponding model and is presented to the testee until he has failed on three consecutive forms. There is no time limit for the completion of the test. The geometric forms are scored in terms of criteria like distortion of shape and rotation (Beery, 1982, 1989; Siewert & Breen, 1983). Currently there are four editions of the VMI available. In 1997 the Beery-Buktenica Developmental Test of Visual-Motor Integration, 4th Edition (VMI-4) was published (Beery, 1997), replacing the Developmental Test of Visual-Motor Integration 3rd Revision or VMI-3 (Beery, 1989). According to Beery (1997), the test itself remained basically unchanged and retains all of the forms, characteristics, and strengths of the original edition. Added to the latest edition, is the provision of two supplemental standardised tests, VMI Visual Perception and VMI Motor Co-ordination. As the VMI (Beery, 1967, 1989, 1997) is designed to

assess the extent to which individuals can integrate their visual and motor abilities, the two new tests are provided to statistically compare an individual's results with the relatively pure visual and motor performances. Either one or both of the standardised supplemental tests may be administered individually after the VMI. However, it is not compulsory. The two additional tests were not used in this study.

Although the forms for the two editions are identical, the method of administration for the first three forms differs. With the new edition, young children can first be instructed to copy these forms in imitation of the evaluator before they copy the same three forms printed in the booklet – this allows the new edition to be administered to younger children. The full 27-item VMI: 1997 is used with pre-school children through to adults and an 18-item version is available for ages 3 to 7 (Beery, 1997). The scoring systems and norms also differ for the two editions. The old edition uses weighted scores (awarding 1 to 4 points for a correctly copied form based on the difficulty of the form) while the new edition simply awards 1 point for each form that is correctly copied (Beery, 1989, 1997). Beery (1997) adds that the VMI was originally normed in 1964 on 1 030 Illinois children. It was cross-validated in 1981 with 2060 Californian children and again in 1989 with a national sample of 2 734 children. The VMI: 1997 and its supplemental Visual and Motor tests were normed in 1996 on 2 614 children from 3 to 18 years of age, from the 5 major sections of the United States. It seems therefore that the VMI norms over time and place have been consistent, particularly at the pre-school and elementary grades levels for which it was designed. According to Mayes and Calhoun (1998) the two editions of 1989 and 1997 are clinically comparable and yield similar results. Although the VMI: 1997 is not yet available in South Africa according to the Human Science Research Council (Filemon Matube, personal communication, August 31, 2000), the VMI: 1997 could be found in the United States of America. The VMI will thus be used for the data collection and scored according to the norms of the two editions, VMI: 1989 and VMI: 1997.

The standard scores of the VMI (Beery, 1967, 1989, 1997) have a mean of 100 and a standard deviation of 15 for all age groups and are based upon the means of raw score distributions. A total of 50 marks can be obtained on the VMI: 1989 and 27 marks on the

VMI: 1997 (Beery, 1989, 1997; Siewert & Breen, 1983). Tables are provided in both manuals where raw scores can be converted to age-equivalent scores. The raw scores can also be converted to standard scores or percentiles (Beery, 1982, 1989; Vorster, 1994).

2.2.5 **The Copying Test of the JSAIS**

The Copying Test has 12 items for which the testee has to draw a figure from an example of configurations of two adjoining figures. This test measures the ability to correctly reproduce a design presented visually. The following more specific skills are supposed to be involved: eye-hand co-ordination, perceptual ability, comprehension of spatial relations as well as visual-motor organisational ability (Madge, 1981a).

A colouring-pencil must be used and each drawing must be done on a separate sheet of paper. The card with the design to be copied is placed immediately above the sheet of blank paper in front of the testee. There is no time limit but if, after approximately 40 seconds, it appears that a testee is unable or unwilling to copy a design, the tester may continue with the next item. The testee's drawings are scored according to the degree to which they meet the specific criteria for each item. The main points to be considered are the curvature of the lines in circular designs and the straightness of the lines in rectangular designs, the relative length of lines, the accuracy of angles and the accuracy of points of closure. There is no penalty for rotations even if a design is rotated by 180 degrees (Madge, 1981b). There are two sets of criteria for each item – the minimum requirements to earn 1 point and additional requirements to earn additional credit. The maximum score is 29. The raw scores can be converted to scale scores for each age group by using the tables of norms in the Manual for the Junior South African Individual Scales Part III (Madge, Van den Berg, & Robinson, 1985).

2.3 **Procedure**

Prior to all procedures, permission to conduct the research was obtained from the Western Cape Education Department. Once the pre-schools were identified with the co-operation of the School Clinic, the relevant teachers/caregivers were contacted. The research was discussed and permission was obtained to do the research on the

institution's premises. They assisted with identifying the target group. The final sample consisted of those children for whom parental permission to conduct the testing has been obtained (according to Addenda D: English version, E: Afrikaans version and F: Xhosa version).

As the present study accomodates South Africa's multi-ethnicity, all correspondence as well as the testing, took place in the child's home language. The parents/guardians were asked to complete a biographical questionnaire. The questionnaires were handed out at school and had to be returned to the teachers within five days. The teachers helped with the co-ordination of the questionnaires, but with the Xhosa questionnaires the help of a contact person from the community was also used. The teachers were asked to judge the testees according to certain competency levels regarding school readiness. As far as development of scholastic skills were concerned, teachers evaluated children from their own classes. A Lickert type scale with scale points between 1 and 7 was used for this purpose (See Addendum J). Care was taken to instruct the teachers about the importance of being objective whilst evaluating the children. It is generally accepted that pre-school teachers have a very realistic view about the abilities of the children they teach (Vorster & Brand, 1995). This information will be used to investigate possible correlations emerging from the data.

Four assistants (psychology students with at least a psychometric background and experience in working with children in a cross-cultural context) were recruited, selected and trained to assist the researcher in conducting the various assessments. The researcher and assistants visited the relevant schools beforehand in order to be familiar with the setting, the participants and to be prepared for possible difficulties and limitations. In order to obtain optimum results, the locations were as familiar to the children, private and relatively quiet as could possibly be. The tests were administered in groups of 12 and the order of administration was counterbalanced. Although the researcher speaks Xhosa as a third language, an interpreter was also used to ensure understanding and reliability. As one of the assistants speaks Xhosa fluently, he was used as interpreter.

Precautions were taken to ensure that the children are unable to see each other's responses. A break was given between sessions. According to the preferences of the participants, the standardised instructions were given in Afrikaans, English or Xhosa (refer to Addenda K: English version, L: Afrikaans version and M: Xhosa version). As the researcher and assistants scored the tests, the researcher cross-checked to ensure interscorer-reliability. Feedback concerning the children was given on request (refer to Addenda N: English version, O: Afrikaans version and P: Xhosa version). In the case of significant developmental deficits, the parents were contacted. The deficits received attention and the teachers were given a program with activities aiming to enhance visual motor integration. The data are used in co-operation with the School Clinic for research purposes and intervention programmes.

2.4 Statistical Techniques and Methods of Analysis

The data were collected in a primarily quantitative manner. It comprised of a correlational study, as relationships between naturally occuring variables were observed. According to Goodwin (1995) correlational procedures are frequently used in research evaluating psychological tests. The relationship between test scores and teacher evaluations of scholastic skills, as well as between test scores and biographical variables, were determined by means of analysis of variance. Correlations between the results of the VMI, the Copying Test and biographical variables were assessed by calculating the Pearson product-moment correlation (Du Toit, 1985). The analyses were done by using the Statistical Package for Social Science (SPSS) (George & Mallery, 1999).

3. RESULTS

3.1 Introduction

The results of the statistical analysis conducted are presented in this section. The raw scores obtained were used for data reduction purposes. As some of the questionnaires were not completed fully, this was taken into account during the statistical analysis.

The 238 participants consisted of 127 (53%) boys and 111 (47%) girls. Their ages ranged between 4 years 9 months and 7 years 0 months, with a mean chronological age of 5 years 10 months. The sample consisted of white (n=66), black (n=71) and coloured

(n=101) children. Language preferences were Afrikaans (n=112); English (n=24); both Afrikaans and English (n=32); Xhosa (n=66) and other languages not included in these categories (n=4). According to Riordan's index for socio-economic status, the sample used in this study consisted of upper (n=86), middle (n=58) and lower (n=25) socio-economic families. According to the combination between ethnicity and SES in this sample, the upper SES group consisted of 44 white, 22 coloured and 20 black families. The middle SES group consisted of 13 white, 40 coloured and 6 black families. The lower SES group consisted of 6 white, 8 coloured and 11 black families.

The Ffooks Symbols Test and the Randot Stereotest were used as screening techniques for children with visual problems. Although several squint-eyed children were screened, no significant visual deficits were present and no children were referred to the optometrist for further assessment. In the case of significant deficits in visual-motor abilities, occupational therapy assessment was recommended. For the purpose of this study, significant deficits were regarded as a performance level of 6 months below chronological age. According to their results in this study, 64 children were referred for further assessment.

3.2 Validity of the VMI: 1989, VMI: 1997 and the Copying Test

The means and standard deviations of the three tests; the VMI: 1989, VMI: 1997 and the Copying Test; are presented in Table 1. For the purpose of this study, the focus is on predictive validity. Guion (Smit, 1991) stated that predictive validity is the extent to which variance in a test (predictor variable) is relevant to the variance in the subsequent criterion measures.

Table 1
Means and Standard Deviations of the VMI: 1989, VMI: 1997 and the Copying Test

TEST	n	$\overline{X}$	SD
VMI : 1989	238	10,19	6,10
VMI : 1997	238	11,72	4,06
Copying Test	238	9,27	6,28

According to Table 1, the distribution of scores on the Copying Test was wider than the distribution of scores on both the VMI versions. The distribution of the VMI: 1989 edition scores was wider than those of the 1997 edition.

The correlations between the results of the two editions of the VMI and the Copying Test were also calculated. The results are reported in Table 2.

Table 2

Pearson Correlation Coefficient Results between Scores on the VMI: 1989, VMI: 1997 and the Copying Test

TEST	VMI: 1989	VMI: 1997
VMI: 1997	0,901**	
Copying Test	0,765**	0,745 **

** $p < 0,01$

As can be seen in Table 2, the Pearson correlation coefficient between the scores on the VMI: 1989 and the VMI: 1997 is statistically significant ($r = 0,901$; $p<0,01$). The coefficient between the scores on the Copying Test and the VMI: 1989 was also significant ($r = 0,765$; $p<0,01$), as were those between the Copying Test and the VMI: 1997 ($r = 0,745$; $p<0,01$).

3.3 Biographical Variables

The correlations between the results of the three tests and certain biographical variables of the testees were calculated. The biographical variables are divided into two categories to distinguish between the variables of the parents and the children. These data were generated by the questions in the biographical questionnaire (See Addendum B).

3.3.1 Variables regarding Childrens' Developmental Background

3.3.1.1 Chronological age

Table 3 shows the correlations between the results of the two editions of the VMI, the Copying Test and the biographical variable, Chronological Age.

Table 3

Correlations between Scores on the VMI: 1989, VMI: 1997, Copying Test and Chronological Age

TEST	n	r
VMI: 1989	238	0,266**
VMI: 1997	238	0,340**
Copying Test	238	0,347**

** $p < 0,01$

According to the obtained results in Table 3, it is clear that all the different tests correlated significantly with Chronological Age. In other words - the older the children, the better they performed on the tests.

3.3.1.2 **Gender**

The relationship between the results of the three tests and the biographical variable, Gender, was calculated by means of analysis of variance. The results are reported in Table 4.

Table 4

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Gender

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Male	127	9,7	5,20	2,169	0,142
	Female	111	10,88	6,95		
VMI: 1997	Male	127	11,45	4,00	1,615	0,205
	Female	111	12,13	4,10		
Copying Test	Male	127	8,93	6,12	1,222	0,270
	Female	111	9,84	6,47		

Table 4 shows that the F-values are not significant ($p>0,05$); and therefore no significant correlation was found for scores on the VMI: 1989, VMI: 1997, Copying Test and

Gender. There is thus no difference between the achievement of boys and girls on any of these tests.

3.3.1.3 **Ethnicity**

The relationship between the results of the three tests and the biographical variable Ethnicity was calculated by means of analysis of variance. The results are reported in Table 5.

Table 5

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Ethnicity

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	White	66	15,02	7,30	37,462	0,000
	Coloured	101	8,42	4,74		
	Black	71	8,21	3,69		
VMI: 1997	White	66	14,85	3,21	34,993	0,000
	Coloured	101	10,44	3,60		
	Black	71	10,63	3,86		
Copying Test	White	66	15,24	6,37	67,112	0,000
	Coloured	101	7,71	5,04		
	Black	71	5,88	3,25		

Table 5 represents the results obtained by the three ethnic groups, to assess whether or not their performance differed significantly. According to Table 5, all the F-values are significant ($p < 0,05$). A significant correlation therefore exists between the scores on the VMI: 1989, VMI: 1997, Copying Test and the biographical variable Ethnicity.

Ethnic grouping has a significant correlation with the childrens' achievement in the different tests. It seems that the mean scores for the white population on all three tests are significantly higher than those of the black and coloured population. The performance of the coloured and black population on the VMI: 1989 and VMI: 1997 shows very little difference. However, the coloured population performed significantly

better on the Copying Test than the black population. It seems that Ethnicity has a less significant effect on the scores obtained on the the two editions of the VMI, especially the VMI: 1997, than on the Copying Test.

3.3.1.4 Birth History

Table 6 reports the correlations between the results of the two editions of the VMI, the Copying Test and the biographical variable Birth History. Information regarding this variable was generated by four questions in the biographical questionnaire which was completed by the parents/guardians (See Addendum G). It served as a broad screening device. The data was recategorised into two categories, Problems and No Problems, referring to whether problems regarding the birth history were experienced, or not.

Table 6

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Birth History

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Problems	23	9,91	5,54	0,218	0,641
	No Problems	180	10,57	6,47		
VMI: 1997	Problems	23	11,83	3,69	0,003	0,955
	No Problems	180	11,88	4,23		
Copying Test	Problems	23	9,91	5,77	0,069	0,793
	No Problems	180	9,54	6,39		

Table 6 shows that the F-values are not significant ($p>0,05$), and therefore no significant correlation was found for scores on the VMI: 1989, VMI: 1997, Copying Test and the biographical variable Birth History.

3.3.1.5 Illnesses with Neurological Implications

The relationship between the results of the three tests and the biographical variable, Illnesses with Neurological Implications, was calculated by means of analysis of variance. The results are reported in Table 7. Information regarding this variable was generated by two questions in the biographical questionnaire which was completed by the parents/guardians (See Addendum G). This was utilised as a broad screening device.

The data were recategorised into two categories, Problems and No Problems, referring to whether the child has had any illnesses with neurological implications, like Encephalitis or Meningitis, or not.

Table 7

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Illnesses with Neurological Implications

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Problems	6	6,33	3,98	2,674	0,104
	No Problems	197	10,62	6,38		
VMI: 1997	Problems	6	9,00	4,34	2,975	0,086
	No Problems	197	11,96	4,14		
Copying Test	Problems	6	4,83	2,71	3,549	0,061
	No Problems	197	9,73	6,34		

Table 7 shows that the F-values are not significant ($p>0,05$); and therefore no significant correlation was found for scores on the VMI: 1989, VMI: 1997, Copying Test and the biographical variable Illness with Neurological Implications.

3.3.1.6 **Accidents**

The relationship between the results of the three tests and the biographical variable, Accidents, was calculated by means of analysis of variance. The results are reported in Table 8.

Table 8

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Accidents

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Yes	12	7,75	3,60	2,398	0,123
	No	191	10,67	6,46		
VMI: 1997	Yes	12	9,42	4,19	4,519	0,035
	No	191	12,03	4,12		
Copying Test	Yes	12	6,50	3,85	3,080	0,081
	No	191	9,78	6,39		

Table 8 shows that two of the F-values are not significant (p>0,05); and therefore no significant correlation was found for scores on the VMI: 1989, Copying Test and the biographical variable, whether the children have been in serious accidents causing head or back injuries, or not. However, there is a significant correlation for the scores on the VMI: 1997 (p<0,05). It seems therefore that the VMI: 1997 is more sensitive to this variable and that children who have been in accidents, obtained lower scores on this test. No significant influence is reported on the VMI: 1989 and the Copying Test.

3.3.2 **Variables regarding Parental Background**

3.3.2.1 **Socio-Economic Status (SES)**

The relationship between the results of the three tests and the biographical variable SES was calculated by means of analysis of variance. The results are reported in Table 9.

Table 9

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Socio-Economic Status

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Lower	25	8,48	4,74	13,514	0,000
	Middle	58	8,40	4,44		
	Upper	86	13,36	7,41		
VMI: 1997	Lower	25	10,60	3,96	15,767	0,000
	Middle	58	10,40	3,78		
	Upper	86	13,77	3,83		
Copying Test	Lower	25	7,63	5,47	18,510	0,000
	Middle	58	7,44	4,84		
	Upper	86	13,00	6,59		

A composite index derived by Riordan (in Tennant, 1986) was used to provide the socio-economic index for each subject (See Addendum A). Table 9 represents the results obtained by the children in the three categories of socio-economic status (SES), to assess whether or not their performance differed significantly. According to Table 9, all the F values are significant (p<0,05). A significant correlation therefore exists between the scores on the VMI: 1989, VMI: 1997, Copying Test and the biographical variable SES.

SES has a significant correlation with the childrens' achievement in the different tests. It seems that the mean scores for the upper category of SES on all three tests, are significantly higher than those of the middle and lower categories. It is also interesting to note that the mean scores on the VMI: 1989 and VMI: 1997 for the middle and lower categories of SES, are significantly higher than the mean scores these categories obtained on the Copying Test.

3.3.2.2 **Marital Status**

Table 10 provides the correlations between the results of the two editions of the VMI, the Copying Test and the biographical variable Marital Status.

Table 10

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Marital Status

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	One parent	59	9,47	5,89	2,263	0,134
	Two parents	142	10,96	6,55		
VMI: 1997	One parent	59	11,15	4,41	2,630	0,106
	Two parents	142	12,20	4,05		
Copying Test	One parent	59	7,35	5,27	11,660	0,001
	Two parents	142	10,60	6,51		

The biographical variable, Marital Status, was initially rated on a 7-point scale. However, for the purpose of this study, based on practicalities, it was divided into two categories. The two categories depend on how many parents are living with the child at home. Table 10 shows that two of the F-values are not significant ($p>0,05$). According to Table 10, no significant correlation was found for scores on the VMI: 1989, VMI: 1997 and the biographical variable Marital Status. There is, however, a significant correlation between the scores on the Copying Test and Marital Status ($p<0,05$).

Although only the results on the Copying Test seem to be significantly affected by the marital status of the parents, it is interesting to note that the mean of each test is higher when there are two parents involved.

3.3.2.3 Qualifications of Mothers

The relationship between the results of the three tests and the biographical variable Mothers' Qualifications was calculated by means of analysis of variance. The results are reported in Table 11.

Table 11

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of the Qualifications of Mothers

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Std 5 / lower	21	7,43	3,19	18,106	0,000
	Std 6 / 7	33	7,88	4,08		
	Std 8 / 9	32	7,84	3,64		
	Std 10	34	8,32	3,11		
	1 / 2 years Tertiary	25	10,52	2,93		
	3 or more Tertiary	56	16,13	8,41		
VMI: 1997	Std 5 / lower	21	10,29	3,39	15,902	0,000
	Std 6 / 7	33	9,33	4,26		
	Std 8 / 9	32	10,34	3,76		
	Std 10	34	10,85	3,15		
	1 / 2 years Tertiary	25	12,72	2,11		
	3 or more Tertiary	56	15,18	3,77		
Copying Test	Std 5 / lower	21	6,10	3,27	32,093	0,000
	Std 6 / 7	33	6,55	3,80		
	Std 8 / 9	32	6,16	3,66		
	Std 10	34	7,79	4,89		
	1 / 2 years Tertiary	25	8,72	4,22		
	3 or more Tertiary	56	16,32	6,14		

According to Table 11, all the F-values are significant ($p<0,05$). A significant correlation therefore exists between the scores on the VMI: 1989, VMI: 1997, Copying Test and the

biographical variable the Qualifications of Mothers. The more educated the mother, the higher the scores of the child on the different tests seem to be.

3.3.2.4 Qualifications of Fathers

Table 12 reports the correlations between the results of the two editions of the VMI, the Copying Test and the biographical variable Fathers' Qualifications.

Table 12

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of the Qualifications of Fathers

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Std 5 / lower	15	8,53	3,54	11,382	0,000
	Std 6 / 7	29	6,86	4,68		
	Std 8 / 9	40	9,53	4,65		
	Std 10	31	9,19	4,35		
	1 / 2 years Tertiary	13	11,00	6,07		
	3 or more Tertiary	48	15,83	7,98		
VMI: 1997	Std 5 / lower	15	11,40	3,78	12,085	0,000
	Std 6 / 7	29	8,83	4,08		
	Std 8 / 9	40	11,45	3,65		
	Std 10	31	11,16	3,42		
	1 / 2 years Tertiary	13	12,62	3,23		
	3 or more Tertiary	48	15,08	3,48		
Copying Test	Std 5 / lower	15	6,40	3,46	15,412	0,000
	Std 6 / 7	29	6,14	4,45		
	Std 8 / 9	40	8,41	4,97		
	Std 10	31	8,71	5,90		
	1 / 2 years Tertiary	13	10,85	5,19		
	3 or more Tertiary	48	15,58	6,44		

According to Table 12, all the F-values are significant ($p<0,05$). A significant correlation therefore exists between the scores on the VMI: 1989, VMI: 1997, Copying Test and the biographical variable the Qualifications of Fathers. The more educated the father, the higher the scores of the child on the different tests seem to be.

3.3.2.5 Careers of both parents

The next two variables, the careers of both parents, were rated on a 11-point scale. These careers were recategorised based on a composite index used by Liddell, Kvalsvig, Shabalala and Qotyana (1994). The relationship between the results of the three tests and the biographical variables, Mothers' Careers and Fathers' Careers, respectively were calculated by means of analysis of variance. The results are reported in Tables 13 and 14.

Table 13

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Mothers' Careers

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Pensioner, sale of substence goods only	16	8,00	4,49	3,334	0,021
	Unskilled manual work	8	6,13	2,85		
	Semi-skilled work	73	10,27	6,79		
	Professional	99	11,71	6,35		
VMI: 1997	Pensioner, sale of substence goods only	16	10,31	4,35	4,549	0,004
	Unskilled manual work	8	8,38	3,70		
	Semi-skilled work	73	11,64	4,12		
	Professional	99	12,81	3,99		
Copying Test	Pensioner, sale of substence goods only	16	6,07	3,49	7,506	0,000
	Unskilled manual work	8	4,11	2,57		
	Semi-skilled work	73	8,97	6,15		
	Professional	99	11,45	6,44		

All the F-values are significant according to Table 13 ($p<0,05$). There appears to be a significant correlation between the scores on the VMI: 1989, VMI: 1997, Copying Test and the biographical variable Mothers' Careers. The level of significance on the VMI: 1989 is much lower than on the VMI: 1997. The Copying Test has the highest level of significance with the variable. It seems that the careers of the mothers have a significant correlation with the childrens' scores on the different tests; especially on the Copying

Test. The children of the mothers who practice a career on a higher, mostly professional, level; obtain better results on the different tests.

The relationship between the results of the three tests and the biographical variable, Fathers' Careers, was calculated by means of analysis of variance. The results are reported in Table 14.

Table 14

Analysis of Variance for Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Fathers' Careers

TEST	CATEGORY	n	$\overline{X}$	SD	F	p
VMI: 1989	Pensioner, sale of substence goods only	10	7,60	3,31	7,629	0,000
	Unskilled manual work	17	7,65	5,71		
	Semi-skilled work	54	8,89	4,39		
	Professional	89	13,02	7,49		
VMI: 1997	Pensioner, sale of substence goods only	10	10,10	3,11	8,866	0,000
	Unskilled manual work	17	9,59	4,74		
	Semi-skilled work	54	10,81	3,49		
	Professional	89	13,52	4,12		
Copying Test	Pensioner, sale of substence goods only	10	6,22	4,66	10,842	0,000
	Unskilled manual work	17	5,71	5,08		
	Semi-skilled work	54	8,38	4,89		
	Professional	89	12,60	6,85		

All the F-values are significant according to Table 14 ($p<0,05$). There appears to be a significant correlation between the scores on the VMI: 1989, VMI: 1997, Copying Test and the biographical variable, Fathers' Careers. The children of the fathers who practice a career on a higher, mostly professional, level obtain better results on the different tests.

3.4 **Rating by the Teachers**

The relationship between the results of the three tests and the rating of the teachers of the childrens' specific academic skills, was calculated by means of analysis of variance.

Table 15 reports the correlations between the results of the two editions of the VMI, the Copying Test and the Teacher Rating of School Readiness.

3.4.1 **School Readiness**

Table 15

Analysis of Variance for Total Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of School Readiness

TEST	RATING	n	$\overline{X}$	SD	F	p
VMI: 1989	1	49	7,16	2,90	13,887	0,000
	2	24	8,50	3,13		
	3	28	7,64	4,11		
	4	58	10,03	5,74		
	5	43	12,86	5,23		
	6	20	15,00	7,33		
	7	8	20,63	12,68		
VMI: 1997	1	49	9,65	3,55	12,739	0,000
	2	24	11,21	2,99		
	3	28	9,86	4,08		
	4	58	11,62	3,66		
	5	43	13,70	2,88		
	6	20	14,65	3,67		
	7	8	17,75	4,17		
Copying Test	1	49	4,86	2,89	26,668	0,000
	2	24	6,29	2,99		
	3	28	7,32	5,53		
	4	58	9,59	5,91		
	5	43	11,44	4,98		
	6	20	16,45	4,93		
	7	8	22,13	7,61		

According to Table 15 there are, for all three tests, significant differences between the mean test scores of the seven levels for School Readiness ($p<0,01$). It therefore seems that the teacher ratings of School Readiness correlate significantly with performance in each test. The children who achieved lower (or higher) scores on the tests, were also rated lower (or higher) by their teachers. It seems, however, that on the VMI: 1989 and VMI: 1997, the mean totals for the second level of the teacher ratings are higher than the third level.

3.4.2 **Reading Ability**

Table 16 reports the correlations between the results of the two editions of the VMI, the Copying Test and the Teacher Rating of Reading Ability.

Table 16

Analysis of Variance for Total Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Reading Ability

TEST	RATING	n	$\overline{X}$	SD	F	p
VMI: 1989	1	53	7,68	2,85	13,120	0,000
	2	21	7,24	3,00		
	3	32	8,00	3,60		
	4	54	10,28	5,80		
	5	51	12,96	5,89		
	6	12	16,17	7,11		
	7	7	20,57	14,60		
VMI: 1997	1	53	10,25	3,47	9,874	0,000
	2	21	9,95	3,31		
	3	32	10,41	3,36		
	4	54	11,74	3,90		
	5	51	13,59	3,37		
	6	12	15,33	3,31		
	7	7	17,14	6,15		
Copying Test	1	53	5,25	3,01	27,525	0,000
	2	21	5,43	2,79		
	3	32	7,47	4,44		
	4	54	9,53	5,61		
	5	51	13,14	6,30		
	6	12	13,33	4,75		
	7	7	24,71	4,57		

According to Table 16 there are, for all three tests, significant differences between the mean test scores of the seven levels for Reading Ability ($p<0,01$). It seems therefore that the teacher ratings of Reading Ability correlate significantly with performance in each test. The children who achieved lower (or higher) scores on the tests, were also rated lower (or higher) by their teachers. It seems, however, that on the VMI: 1989 and VMI: 1997, the mean totals for the first level of the teacher rating are higher than the second level.

3.4.3 **Arithmetic Ability**

The relationship between the results of the three tests and the Teacher Rating of Arithmetic Ability, was calculated by means of analysis of variance. The results are reported in Table 17.

Table 17

Analysis of Variance for Total Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Arithmetic Ability

TEST	RATING	n	$\overline{X}$	SD	F	p
VMI: 1989	1	48	7,46	2,67	13,539	0,000
	2	33	6,97	3,16		
	3	26	8,19	2,91		
	4	50	11,60	5,95		
	5	49	12,47	6,60		
	6	17	13,06	6,20		
	7	7	22,14	12,89		
VMI: 1997	1	48	10,00	3,37	10,877	0,000
	2	33	9,58	3,46		
	3	26	10,85	2,94		
	4	50	12,60	3,88		
	5	49	13,22	3,80		
	6	17	13,59	3,52		
	7	7	18,43	3,99		
Copying Test	1	48	4,94	2,65	25,551	0,000
	2	33	5,70	3,41		
	3	27	7,19	3,21		
	4	50	11,26	5,89		
	5	49	12,61	6,58		
	6	17	11,24	5,47		
	7	7	23,86	6,28		

According to Table 17 there are, for all three tests, significant differences between the mean test scores of the seven levels for Arithmetic Ability ($p<0,01$). It seems therefore that the teacher ratings of Arithmetic Ability correlate significantly with performance in each test. The children who achieved lower (or higher) scores on the tests, were also rated lower (or higher) by their teachers. It seems, however, that on the VMI: 1989 and VMI: 1997, the mean totals for the first level of the teacher rating are higher than the

second level. The Copying Test also indicates higher mean totals for the fifth level of the teacher rating than the sixth level.

3.4.4 **Writing Ability**

The relationship between the results of the three tests and the Teacher Rating of Writing Ability, was calculated by means of analysis of variance. The results are reported in Table 18.

Table 18

Analysis of Variance for Total Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Writing Ability

TEST	RATING	n	$\overline{X}$	SD	F	p
VMI: 1989	1	58	7,21	3,11	17,650	0,000
	2	30	6,73	2,59		
	3	25	8,84	3,00		
	4	57	11,07	5,76		
	5	34	12,68	5,09		
	6	19	17,16	7,32		
	7	7	20,00	14,09		
VMI: 1997	1	58	9,72	3,72	15,467	0,000
	2	30	9,33	2,80		
	3	25	11,32	2,64		
	4	57	12,40	3,68		
	5	34	13,53	3,04		
	6	19	15,79	3,52		
	7	7	17,43	4,76		
Copying Test	1	58	4,93	2,90	30,371	0,000
	2	30	5,07	3,06		
	3	26	8,50	4,82		
	4	57	10,60	5,31		
	5	34	13,06	5,95		
	6	19	15,63	5,74		
	7	7	22,00	8,21		

According to Table 18 there are, for all three tests, significant differences between the mean test scores of the seven levels for Writing Ability ($p<0,01$). It therefore seems that the teacher ratings of Writing Ability correlate significantly with performance in each

test. The children who achieved lower (or higher) scores on the tests, were also rated lower (or higher) by their teachers. It seems, however, that on the VMI: 1989 and VMI: 1997, the mean totals for the first level of the teacher rating are higher than the second level.

3.4.5 **Fine Motor Skills**

Table 19 reports the correlations between the results of the two editions of the VMI, the Copying Test and the Teacher Rating of Fine Motor Skills.

Table 19

Analysis of Variance for Total Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Fine Motor Skills

TEST	RATING	n	$\overline{X}$	SD	F	p
VMI: 1989	1	44	7,80	2,70	16,021	0,000
	2	29	8,17	3,94		
	3	43	8,67	5,07		
	4	49	9,57	4,02		
	5	43	12,21	5,52		
	6	17	17,76	8,71		
	7	5	24,00	15,10		
VMI: 1997	1	44	10,48	3,09	10,484	0,000
	2	29	10,41	3,95		
	3	43	10,60	3,66		
	4	49	11,49	3,61		
	5	43	13,35	3,03		
	6	17	15,53	4,86		
	7	5	19,20	4,49		
Copying Test	1	44	5,02	2,62	25,608	0,000
	2	29	7,34	4,77		
	3	43	7,72	5,47		
	4	49	9,24	4,72		
	5	43	11,63	5,61		
	6	17	18,00	6,31		
	7	5	24,80	7,36		

According to Table 19 there are, for all three tests, significant differences between the mean test scores of the seven levels for Fine Motor Skills ($p<0,01$). It seems therefore

that the teacher ratings of Fine Motor Skills correlate significantly with performance in each test. The children who achieved lower (or higher) scores on the tests, were also rated lower (or higher) by their teachers. It seems, however, that on the VMI: 1997, the mean total for the first level of the teacher rating is higher than the second level.

3.4.6 **Ability to Concentrate**

Table 20 reports the correlations between the results of the two editions of the VMI, the Copying Test and the Teacher Rating of Concentrating Ability.

Table 20

Analysis of Variance for Total Scores on the VMI: 1989, VMI: 1997 and Copying Test in terms of Ability to Concentrate

TEST	RATING	n	$\overline{X}$	SD	F	p
VMI: 1989	1	46	7,59	3,21	10,915	0,000
	2	37	9,24	4,22		
	3	31	8,35	3,89		
	4	40	9,30	4,21		
	5	40	13,08	6,90		
	6	31	13,13	7,42		
	7	5	23,40	14,91		
VMI: 1997	1	46	10,13	3,34	6,938	0,000
	2	37	11,30	3,91		
	3	31	10,71	3,16		
	4	40	11,30	3,54		
	5	40	13,58	4,02		
	6	31	13,39	4,21		
	7	5	18,00	5,20		
Copying Test	1	46	5,28	2,94	12,584	0,000
	2	37	7,70	5,22		
	3	31	8,10	5,66		
	4	40	9,80	5,24		
	5	40	12,20	6,02		
	6	31	12,19	7,73		
	7	5	22,20	7,85		

According to Table 20 there are, for all three tests, significant differences between the mean test scores of the seven levels for Ability to Concentrate ($p<0,01$). It seems

therefore that the teacher ratings of the Ability to Concentrate correlate significantly with performance in each test. The children who achieved lower (or higher) scores on the tests, were also rated lower (or higher) by their teachers. It seems, however, that on the VMI: 1989 and the VMI: 1997, the mean totals for the second level of the teacher rating are higher than the third level.

The overal tendency, according to Tables 15-20, appears to be that children who were rated lower on the 7-point scale by their teachers, also scored lower on the different tests.

3.4.7 **Correlation Amongst Teacher Ratings**

Table 21 reports the correlations between the results of all the teacher ratings of the specific academic skills mutually. The correlations between the results of the three tests and the teacher ratings of these specific academic skills, were calculated by means of the Pearson product-moment correlation. The results are reported in Table 22.

Table 21

Pearson Product-Moment Correlation between Teacher Ratings of Specific Academic Skills Mutually

	S	R	A	W	F
S					
R	0,908**				
A	0,881**	0,910**			
W	0,903**	0,894**	0,885**		
F	0,875**	0,853**	0,818**	0,854**	
C	0,842**	0,797**	0,777**	0,794**	0,832**

** $p<0,01$

Note the abbreviations used in Table 21: S = School Readiness; R = Reading Ability; A = Arithmetic Ability; W = Writing Ability; F = Fine Motor Skills; C = Concentration.

Table 21 clearly shows significant correlations between the different teacher ratings of the childrens' specific academic skills. The highest correlations are between the ratings of reading and arithmetic ability ($r = 0,910$; $p<0,01$), reading ability and school readiness

(r = 0,908; p<0,01), as well as school readiness and writing ability (r = 0,903; p<0,01). There appears to be a significant correlation between the teacher ratings of school readiness, reading and writing ability.

Table 22

Correlation between the VMI: 1989, VMI: 1997, the Copying Test and Teacher Ratings of Specific Academic Skills Mutually

	VMI: 1989	VMI: 1997	Copying Test
S	0,476**	0,458**	0,607**
R	0,462**	0,418**	0,598**
A	0,464**	0,438**	0,579**
W	0,536**	0,522**	0,651**
F	0,460**	0,403**	0,576**
C	0,397**	0,343**	0,464**

** p<0,01

Note the abbreviations used in Table 22: S = School Readiness; R = Reading Ability; A = Arithmetic Ability; W = Writing Ability; F = Fine Motor Skills; C = Concentration.

According to the obtained results in Table 22, significant relationships were found between scores on the VMI: 1989, VMI: 1997, Copying Test and the teacher evaluations of the six specific academic skills. The highest correlation of the VMI: 1989 was with writing ability (r = 0,536; p<0,01) and the lowest correlation was with the ability to concentrate (r = 0,397; p<0,01). Writing ability showed the highest correlation with the VMI: 1997-results (r = 0,522; p<0,01) and the ability to concentrate, the lowest (r = 0,343; p<0,01). The highest correlation of the Copying Test was with writing ability (r = 0,651; p<0,01) and the lowest correlation was the ability to concentrate (r = 0,464; p<0,01). According to these results, it appears that the three tests correlated the highest with the variable, the ability to learn writing, and correlated lowest with the variable, ability to concentrate. The Copying Test also showed higher correlations with the teacher ratings of the six specific academic skills than the VMI: 1989 and VMI: 1997.

4. DISCUSSION

4.1 General Discussion

The primary aim of the study was to determine the predictive validity of the American VMI (Beery, 1989, 1997) in a multi-ethnic South African context. The objectives were to determine the correlations between the results of the VMI: 1989, VMI: 1997 and the Copying Test, as well as the correlation between the results of the VMI: 1989, VMI: 1997, Copying Test and certain biographical variables of the testees. Lastly, the correlations between the results of the VMI: 1989, VMI: 1997, Copying Test and the teacher judging of the testees's competencies, were also taken into consideration.

4.1.1 The Correlation between the VMI: 1989, VMI: 1997 and the Copying Test

According to Table 2, the correlations between the scores on the three different tests of visual-motor integration is statistically significant. A particularly high positive correlation was found between the 1989 and 1997 editions of the VMI. As expected, the two different versions of the VMI offered concurring results for children at a pre-school level. According to Beery (1997) the 4-point scores of the VMI: 1989 scoring system correlated almost perfectly with earlier 1-point scoring ($r = 0,98$). The same standard score and other derived score tables apply for the VMI: 1997.

The VMI: 1989's sensitivity to individual differences, particularly among older children, was increased by the added 26 marks used for scoring (Beery, 1989). According to Beery (1989) older children can be defined as eight years and older. The VMI: 1997 is used with pre-school children through to adults, particularly among younger children – even children as young as 28 weeks (Beery, 1997). The expanded criteria of the VMI: 1989 and VMI: 1997 seem to have no significant effect on the young sample used in this study. It seems therefore that the VMI: 1989 and the VMI: 1997 are clinically comparable and yield similar results, as supported by Mayes and Calhoun (1998), for this sample consisting of pre-school children between 5 and 7 years old.

Vorster (1994); who applied the VMI: 1982, VMI: 1989 and the Copying Test to a sample of 40 pre-school children; found a significant relationship between the results of the VMI: 1982, VMI: 1989 and the Copying Test. Brand and Le Roux (1991) concluded

that both the VMI and Copying Test measure one principal factor which can be interpreted as a visual-motor integration factor. This finding confirms the construct validity of both scales, and is in line with the views of Concha (1989), as well as Polubinski, Melamed and Prinzo (1986). Leonard (1986) compared the scores of 40 white 6-year olds on the Motor-Free Visual Perception Test (MVPT) with the VMI, Copying Test and four subtests of the Reitan-Indiana Neuropsychological Test Battery. She found significant relationships between the scores on the MVPT, VMI and Copying Test.

The main aim of this study was to analyse the nature of the relationship between scores on the Copying Test (Madge, 1981) and the two VMI-editions (Beery, 1989, 1997) in an effort to determine whether the VMI offers valid results for a South African group of children. Research on the use of the VMI in South Africa also offers conflicting findings and the validity of VMI results in the South African context has already been queried by several researchers (Schlodder, 1986; Skolimowska, 1978). However, as there is a significant correlation between the scores on the VMI: 1989, VMI: 1997 and the Copying Test in this study; it corroborates the validity of the VMI for use in the South African context. Therefore it can be concluded that both editions of the VMI correlated with a criterium (Copying Test) in an acceptable manner. This finding confirms the empirical validity of the VMI.

4.1.2 The correlation between the VMI: 1989, VMI: 1997, the Copying Test and certain Biographical Variables

4.1.2.1 Variables regarding Childrens' Developmental Background

- **Chronological Age**

According to the obtained results in Table 3 it is clear that the VMI: 1989, VMI: 1997 and the Copying Test correlated significantly with chronological age. Younger children obtained significantly lower scores than older children on these three tests of visual-motor integration. These results are supported by Beery (1989, 1997) as he stated that the VMI is specifically designed to measure changes in eye-hand-co-ordination as children grow older. VMI scores correlate as high as 0,89 with chronological age. The VMI: 1997 scores correlate as high as 0,83 with chronological age. These findings also

agree with the norm establishment of the Copying Test. Norms were calculated by a cumulative frequency distribution for each of the three monthly age groups (Madge, 1981a). However, Helm (1989) assessed 530 urban black children with the VMI and the Developmental Test of Visual Perception of Frostic. Her results contradict the findings of this study as she concluded that the standard scores obtained by the subjects showed a significant difference between a number of the age groups. It also appeared that performance did not improve consistently with an increase in age. Helm urged that the tests must only be used with younger children (i.e. children younger than eleven years of age).

As cited in the literature review, the findings of this study are confirmed by Vorster (1994). The assumption was therefore that achievement differs according to chronological age. It is also interesting to note that the scores on the Copying Test correlated higher with chronological age, than the scores on the VMI: 1989 and the VMI: 1997. It seems therefore that the Copying Test is more sensitive to chronological age.

- **Gender**

Table 4 shows that there seems to be no significant correlation between the VMI: 1989, VMI: 1997, Copying Test and gender. Finding that the correlations between the test scores and gender were not significant, confirmed the results of Aylward and Schmidt (1986), Hanekom (1991), Schlodder (1986), Skolimowska (1978) and Williams (1983). This finding is contradicted by Beery (1967b) who found that girls were superior to boys in visual-motor development. Leonard (1986) also found that the relationship between the MVPT and the Copying Test was significant for females. However, tests for homogeneity of regression indicated that these differences were not significant. Thus, in summary, the relationship between performance on the tests is essentially the same for males and females. The researcher agrees with these findings and is consistent with those of Beery (1982, 1997), Vorster (1994), as well as Weil and Cunning-Amundson (1994).

- **Ethnicity**

The biographical variable, ethnicity, also correlated significantly with the obtained results in Table 5 on the VMI: 1989, VMI: 1997 and the Copying Test. The white population

scored significantly higher on the three tests of visual-motor integration than the coloured and black populations. Schlodder (1986) and Tennant (1986) agree that cultural background has a very small influence on test scores. Helm and Concha (1990) also add that the diagnostic and prognostic relevance of the VMI for other ethnic groups must be questioned. Skolimowska (1978) concluded that the rate of perceptual motor development described by the VMI developmental norms may be culture-specific. As cited in the literature review, Helm (1989) concluded that the VMI and the Developmental Test of Visual Perception of Frostic appeared to be unappropriate for the assessment of black, urban children. The researcher does not view the VMI as an unappropriate assessment tool for other ethnic groups; but realises the essence of recognising the cultural varieties in South Africa. However, Beery (1982, 1997) described the test as being "relatively culture independent" and he stated that separate norms were not felt to be warranted for different ethnic groups. He states that the VMI appears to be essentially culture free. The obtained results of this study seem to contradict the findings of Beery (1982, 1997). However, the results of each ethnic group on the two editions of the VMI, especially the VMI: 1997, are not as widely distributed as on the Copying Test. It seems therefore that the impact of Ethnicity is less on scores obtained on the VMI, especially the VMI: 1997, than on the Copying Test. In South Africa ethnicity is likely to imply differences in variables like SES, qualifications and careers. Such factors would have to be controlled to come to conclusions regarding visual-motor integration performance.

Mao, Li and Lo (1999) administered the VMI to 314 Taiwanese children aged 3 years 3 months to 13 years 3 months. The results revealed that the 24 items of the VMI test measure an unidimensional construct. However, the subjects experienced difficulty with some of the items. When the item-order was revised, the scores of half of the subjects were affected. Whether or not this means that the original sequence should in fact be changed, remains unclear. It should be kept in mind that the goal of adapting the VMI test for cross-cultural use is not to eliminate or obscure real differences in the abilities of visual-motor integration among cultures, but to accurately measure the abilities of children from different cultures. Mao, Li and Lo (1999) conclude by emphasising the

necessity of examining the construct of the VMI test and the sequence of item difficulty before applying its results to children with different cultural backgrounds.

The reseacher agrees with this conclusion and urges further investigation of the standardisation and validity of the VMI test for children with different cultural backgrounds by controlling these factors.

- **Birth History**

According to Table 6 there seems to be no significant correlation between the VMI: 1989, VMI: 1997, Copying Test and birth history as operationalised according to four questions (See Addendum G). Although this finding is confirmed by Vorster (1994), the researcher urges further investigation of the effect of birth history on visual-motor integration. Goyen, Lui and Woods (1998) examined 83 neurologically and intellectually normal very-low-birthweight children at age 5 to determine the relationship between visual-motor deficits and very-low-birth-weight children. Their results contradict the findings of this study and indicated that very-low-birth-weight children at school age, despite having normal intelligence and neurological functioning, are at risk of minor morbidities such as fine motor and possible visual-motor dysfunction. This variable was, however, not sufficiently researched in this study.

- **Illnesses with Neurological Implications**

Table 7 shows no significant correlation between the VMI: 1989, VMI: 1997, Copying Test and illnesses with neurological implications as operationalised according to four questions (See Addendum G). Although this finding is confirmed by Vorster (1994), the researcher urges further in depth investigation of the effect of illnesses with neurological implications on visual-motor integration.

- **Accidents**

According to Table 8 there seems to be no significant correlation between the VMI: 1989, VMI: 1997, Copying Test and parental report on accidents causing severe head or back injuries. Although this finding is confirmed by Vorster (1994), the researcher urges further investigation of the effect of these accidents on visual-motor integration.

4.1.2.2 Variables regarding Parental Background

- **SES**

Table 9 shows that SES correlated significantly with the scores on the VMI: 1989, VMI: 1997 and Copying Test. The upper SES-group scored significantly higher on the three tests of visual-motor integration than the middle and the lower groups. Baard (1988) supports these findings. Beery (1989) concludes that the VMI is a particularly good predictor of the achievement of lower SES-groups. Janse van Rensburg (1992) agrees that children from lower socio-economic backgrounds have less developed skills in visual perception. According to Dawes and Donald (cited in Baard, 1998), it has been estimated that there is a high risk of developmental problems among many South African children, due to their socio-economic and health status. Poverty, familial strain, overcrowding, violence and pervasive climate of change in South Africa have all contributed to an increased risk of developmental problems. It is also interesting to note that the scores of all three SES-groups are higher on the VMI: 1997 than on the VMI: 1989. The assumption may be made that the VMI: 1989 appears to be a more specific predictor of SES than the VMI: 1997. The Copying Test also correlated significantly with SES. The mean scores for each ethnic grouping on the Copying Test differ significantly from each other. It appears that the Copying Test distinguishes more efficiently between the three different SES-groups than the two VMI editions and is therefore a more specific predictor of SES.

However, Leonard (1986) and Vorster (1994) found that SES has no significant effect on the scores obtained on the Copying Test. Although the obtained results of this study therefore seem to contradict these findings, it is interesting to note that Leonard (1986) and Vorster (1994) used samples consisting of only white children with fairly equal proportions of upper, middle and lower SES. It seems that SES has a less significant effect on the scores obtained on the two editions of the VMI, especially the VMI: 1997, than on the Copying Test. The assumption may be made that the South African standardised Copying Test is more sensitive for developmental deficits amongst children due to their socio-economic status.

- **Marital Status**

According to Table 10 there seems to be no significant correlation between the VMI: 1989, VMI: 1997 and Marital Status. This finding is confirmed by Vorster (1994). A significant correlation was found between the scores on the Copying Test and Marital Status. The assumption may be made that the Copying Test is a more specific predictor of environmental influence (referring to parental and familial factors) than the two editions of the VMI. It is also interesting to note that the average of each test appears to be higher when there are two parents in the household. This may be explained by the fact that two parents usually have more time to spend with their child than what a single parent does.

- **Qualifications of both parents**

According to Tables 11 and 12, the qualifications of both parents correlated significantly with the scores on the VMI: 1989, VMI: 1997 and Copying Test. It appears that the higher the educational level of the parents, the higher scores were obtained by the children. The mean scores obtained on the VMI: 1997 are higher for both parents than on the VMI: 1989. The assumption may be made that the VMI: 1997 appears to be a more specific predictor of environmental influence (referring to intellectual stimulation and educational exposure) than the VMI: 1989. The mean scores obtained on the VMI: 1997 and VMI: 1989 are higher for both parents than on the Copying Test. The assumption may be made that the VMI (1989, 1997) is a more specific predictor of environmental influence (referring to intellectual stimulation and educational exposure) than the Copying Test.

Vorster (1994) contradicts these findings as she found no significant correlations between the scores on the three tests and the educational level of parents. However, according to Garber and Slater (1983), children frequently lag in their perceptual-motor development and learning if they experience sustained environmental restrictions. These children are characterised as being deprived from those rich experiences which should have been theirs, brought about by poverty, by meagreness of intellectual resources in the home and surroundings, including illiteracy of the parents.

- **Careers of both parents**

A significant correlation was also found between the careers of both parents and the scores on the VMI: 1989, VMI: 1997 and Copying Test (See Tables 13-14). It may therefore be postulated that the higher the professional level of the parents, the higher scores were obtained by the children. A positive correlation between parental educational levels/occupation groups and visual-motor scores on the VMI: 1989, was also found by Goyen, Lui and Woods (1998).

The qualifications of both parents comply with higher score means on the VMI: 1997 than on the VMI: 1989. The assumption may be made that the VMI: 1997 appears to be a more specific predictor of environmental influence (referring to intellectual stimulation and educational exposure) than the VMI: 1989. The qualifications of both parents scored higher means on the two editions of the VMI than on the Copying Test. The assumption may be made that the VMI (1989, 1997) is a more specific predictor of environmental influence (referring to intellectual stimulation and educational exposure) than the Copying Test.

4.1.3 The correlation between the results of the VMI: 1989, VMI: 1997, Copying Test and the Teacher Rating of Specific Academic Skills

- **School Readiness**

Significant relationships were found between the scores on the VMI: 1989, VMI: 1997, Copying Test and the teacher ratings of general school readiness (See Table 15). As cited in the literature review, several researchers agree that visual-motor integration has a definite influence on a child's ability to master reading, writing and arithmetic skills at school entrance level (De Jager, 1982; Hanekom, 1991; Hanekom & Robinson, 1991; Vorster & Brand, 1995).

According to Reynolds, Wright and Wilkinson (1980), scores on the VMI were significant predictors of academic progress in a group of pre-school children over a two year period. Madge (1981a) emphasises that a good performance in the copying of figures is significantly related to scholastic achievement. Baard (1998) concludes by stating that impairments in visual-motor integration can contribute to scholastic failures which may mistakenly be attributed to laziness or lack of co-operation. Vorster (1994)

confirmed these findings. It seems therefore that several researchers agree with the findings of this study with regard to the importance of visual-motor integration for school readiness.

- **Reading Ability**

According to Table 16 significant relationships were found between the VMI: 1989, VMI: 1997, Copying Test and reading ability as rated by the teachers. Vorster (1994) confirmed these findings. Beery (1989, 1997) stated that correlations between form copying and early reading achievement have generally ranged from about 0,40 to 0,60. Robinson (1986) determined that children with reading problems obtained significantly lower scores on the Copying Test, than children without reading problems. She attributed the lower scores to various reasons, one being a lack of concentration. Hanekom (1991) found that Copying Test scores showed a positive correlation with teacher evaluations of reading progress. Summarising these findings, there appears to be a significant association between the ability to read and visual-motor integration.

- **Arithmetic Ability**

Significant relationships were found between the scores on the VMI: 1989, VMI: 1997, Copying Test and the teacher ratings of arithmetic ability (See Table 17). As Beery (1989) adds that the VMI has a tendency to correlate more highly with arithmetic than with reading; the obtained results of this study confirm these findings. Vorster (1994) had similar findings. Interculturally, VMI correlations have ranged from 0,51 to 0,73 for mathematics among fifth and sixth grade Taiwanese children (Beery, 1997). They have ranged from 0,65 to 0,67 among Japanese children 11 to 15 years old. According to these findings, it seems that results on these tests of visual-motor integration correlate with arithmetic ability.

- **Writing Ability**

According to Table 18 significant relationships were found between the VMI: 1989, VMI: 1997, Copying Test and writing ability as rated by the teachers. Vorster (1994) confirmed these findings. Beery (1989) stated that factor analytic studies have indicated

that visual-motor integration was the underlying key factor for handwriting performance. Goyen, Lui and Woods (1998) urge that children experiencing problems with visual-motor integration must be targeted for early intervention prior to school entry as they may experience difficulties with handwriting, self-care tasks and play activities. Summarising these findings, there appears to be a significant relationship between the ability to write and visual-motor integration.

- **Fine Motor Skills**

According to Table 19 significant relationships were found between the VMI: 1989, VMI: 1997, Copying Test and the teacher ratings of fine motor skills. Vorster (1994) confirmed these findings. Baard (1998) adds that a good standard of performance in gross and fine motor skills is considered a prerequisite to young children's steady progress and full participation in their lessons at school. According to these findings, it seems that results on these tests of visual-motor integration correlate with fine motor skills.

- **Ability to Concentrate**

Significant relationships were found between the scores on the VMI: 1989, VMI: 1997, Copying Test and the teacher ratings of the ability to concentrate (See Table 20). Hanekom (1991) adds that concentration plays an important role in the Copying Test. According to Table 22 the ability to concentrate has the lowest correlation (of all the teacher ratings) with the VMI: 1989, VMI: 1997 and the Copying Test. However, all the correlations were significant ($p<0,01$). The lowest correlation was between the VMI: 1997 and the ability to concentrate. It seems, according to the obtained results, that the three tests of visual-motor integration are less influenced by concentration than by the other scholastic skills like school readiness, reading ability, writing ability, arithmetic ability and fine motor skills. These results are confirmed by Vorster (1994).

- **The correlation between the Teacher Ratings of Specific Academic Skills Mutually**

Table 21 reports significant correlations between the teachers' mutual ratings of reading and arithmetic ability, reading ability and school readiness, as well as school readiness and writing ability. According to the obtained results, it appears that school readiness correlates strongly with reading, writing and arithmetic ability. These results confirm the consistency of the teacher ratings of the specific academic skills. This finding is consistent with Vorster and Brand (1995) who stated that it is generally accepted that pre-school teachers have a very realistic view about the abilities of children they teach.

- **The correlation between the VMI: 1989, VMI: 1997, Copying Test and Teacher Ratings of Specific Academic Skills Mutually**

The significant relationships between scores on the VMI: 1989, VMI: 1997, the Copying Test and the teacher ratings of specific academic skills, confirm that the three tests offer valid measurements of scholastic skills with regard to the pre-school sample used in this study. Hanekom (1991) used a sample of 240 white pre-school children and concluded that the Copying Test scores showed a positive correlation with teacher ratings of reading progress, mathematical ability and writing development ($p<0,001$). Friedman, Fuerth and Forsyth (1980) contribute by stating that the VMI offers a significant prediction of global academic performance with 9 year olds ($p=0,007$). The results of the present study also support the findings of Robinson (1986), Vorster (1994), Webb (1985) as well as Webb and Abe (1984).

4.2 Conclusions and Recommendations

As cited earlier, a need exists in South Africa for appropriate diagnostic materials which can be utilised by child development- and health professionals for psychological assessment. This need is most evident in relation to the practical assessment of the developmental status of especially African children (Richter, Griesel & Rose, 1994). The lack of appropriate and standardised psychometric materials often hampers attempts to assess children who evidence developmental problems. By implication, this lack may also hinder attempts to intervene appropriately, since assessment outcomes frequently

form the basis of recommendations for diagnostic and remedial services. Therefore, this study focused on the pressing need existing in general for developmental research in South Africa from a multi-ethnic perspective.

According to the obtained results of this study, the scores on the VMI: 1989 showed a higher correlation with the Copying Test (r = 0,765) than the VMI: 1997 (r = 0,745). If the proportion of the variance (r^2) which is explained by the respective correlations, i.e. 58 % and 56 %, is taken into account, the difference seems to be very small. Therefore it can be concluded that both editions of the VMI correlated with the Copying Test in an acceptable manner. This finding confirms the empirical validity of the VMI. This implicates the possibility that the VMI may be used as a diagnostic tool for assessing visual-motor integration for South African pre-school children.

A particularly high positive correlation (r = 0,901) was found between the 1989 and 1997 editions of the VMI. The two different versions of the VMI offered concurring results for children at a pre-school level. However, it is recommended that further research is undertaken with higher age groups to establish whether the same level of resemblance will occur.

Significant correlations were found between scores on the three tests of visual-motor integration and the biographical variables Chronological Age, both Parents' Careers, both Parents' Qualifications, SES and Ethnicity. According to the obtained results, it seems that the Copying Test is a more specific predictor of SES than the two VMI editions. The VMI, especially the VMI: 1997, shows less discrepancy between scores for each SES-group. The assumption can be made that the Copying Test is more strongly influenced by SES. Although differences in ethnicity in South Africa is likely to imply differences in SES, it seems that the VMI is still able to accurately measure the abilities of children from different SES.

The discrepancy between the test performance of the three ethnic groups, suggests that the rate of the perceptual motor development described by the VMI developmental norms

may be culture-specific. However, the results of each ethnic group on the two editions of the VMI, especially the VMI: 1997, are not as widely distributed as on the Copying Test. It therefore seems that the impact of Ethnicity is less on scores obtained on the VMI, especially the VMI: 1997, than on the Copying Test. The findings of the present study therefore imply that the interchangeability of the Copying Test and the VMI, especially the VMI: 1997, in clinical use is acceptable within the South African context. According to the findings of the researcher, the VMI is more acceptable to use in South Africa when more culture fair results are needed. Future research with larger multi-ethnic samples are recommended in an attempt to establish whether the same findings and results will occur.

There seems to be no significant correlation between the results of the three tests and the following biographical variables: Gender; Birth History; Illnesses with Neurological Implications and Accidents causing head or back injuries. The biographical variable Marital Status correlated significantly with the results on the Copying Test, but not with those on the two editions of the VMI. A limitation of this study is that the variables Birth History, Illnesses with Neurological Implications and Accidents causing head or back injuries, were not sufficiently researched. The researcher also found that the question regarding the Apgar-score in the biographical questionnaire was not sufficiently understood by parents/guardians and needed to be explained. The parents/guardians were unable to rate the Apgar-score according to the three categories – normal, abnormal or not available. It seems that a more descriptive question is needed as the majority did not understand the term.

The VMI: 1989, VMI: 1997 and the Copying Test correlated significantly with teacher ratings of specific academic skills. As the obained results correlated significantly with reading abilty, writing ability, arithmetic ability and school readiness; the consistency of teacher ratings are confirmed. It also corroborates the validity of the VMI in the South African context.

The relationship between socio-economic variables, ethnicity and performance on developmental indices, is of particular significance in the South African context.

According to the obtained results of this study, it seems that Ethniticy and SES had a less significant effect on the scores obtained on the two editions of the VMI, especially the VMI: 1997, than on the Copying Test. As the VMI is relatively simple and quick to administer and score; can be administered as a group test; has a structured nature and is inexpensive; it has several advantages as a diagnostic and prognostic assessment tool. Practical observation of the researcher was that the children thorougly enjoyed completing the VMI and found it easier than the Copying Test. As the Copying Test consists of a booklet as well as paper sheets, more assistance was needed during administration. The recommendation of the researcher is thus that the VMI is the more appropriate diagnostic tool to use when multi-ethnic pre-school children are assessed.

The obtained results of this study can be applied in terms of a systemic-theoretical approach, as it takes the impact of the environment on the child's development into consideration. As the General Systems Theory of Bronfenbrenner (1977, 1979) emphasises the ecological framework, the impact of the environment is hereby realised. The environmental impact, from micro to macro social levels, on development as well as the interrelationships between the different systems which may effect the child, demonstrates the need to account for the wide range of systems that impact on the developing child. Ogbu (1981) adds that the ecological framework has made room for a more culturally sensitive approach to development, as well as to interventions.

Considering the overall results of this study, the interchangeability of the Copying Test and the VMI, especially the VMI: 1997, in clinical use is acceptable in the South African context. The Developmental Test of Visual-Motor Integration thus offers significant predictive validity, as well as a valid indication, of the visual-motor integration development in the sample of pre-schoolers used.

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6. ADDENDUM A

The Numerical Occupation Classification Scale

(Adapted from Tennant, 1986)

Classification of Breadwinner's Occupation

Occupation Classification	Score
Highly qualified professional, executive, administrative and techinical occupations	9
Professional, administrative and managerial workers	8
Commercially independent	7
Lower qualified administrative, technical and clerical with limited supervisory responsibility	6
Skilled workers and artisans with trade qualifications	5
Routine clerical and administrative workers, service and sales workers	4
Semi-skilled production and manual workers	3
Unskilled production and manual workers	2
Not economically active or productive	1
No response	0

Classification of Breadwinner's Education

Father's Education	Score
Attended university	7
Trained at Post-matric level (not university)	6
Matric	5
Apprenticeship	4
Junior Certificate	3
Primary School	2
No education	1
No response	0

Classification of Socio-economic Status

	Lower	**Middle**	**Upper**
White	2 – 10	11 – 13	14 – 16
Coloured	2 – 6	7 – 10	11 – 16
Indian	2 – 6	7 – 10	11 – 16
Black	2 – 5	6 - 10	11 – 16

ADDENDUM B

Pre-schools informative letter: English

I am currently doing research for my Master's Degree in Counselling Psychology at the University of Stellenbosch. The research is regarding the preschool child's visual-motor integration. Visual-motor integration plays an important role in the development of the child. This involves the effective working together of the eyes and muscles of the body and plays an important role in letter recognition, writing, copying figures and drawing. Visual-motor integration problems can have far-reaching consequences for the child's physical and psychological well-being and problems should therefore be detected as early as possible. Visual-motor integration is also an essential part of school readiness.

Two tests are widely used as screening techniques for visual-motor abilities – the **Beery Developmental Test for Visual-Motor Integration** developed for American circumstances and the South African **Copying Test**, developed by the Human Science Resource Council for South African children. Both tests are used regularly for the assessment of school readiness.

It is aimed to conduct both these tests with a sample of preschool children to determine whether there is a significant correlation between the results. By establishing this, the validity and reliability of the Beery Developmental Test for Visual-Motor Integration in a multi-ethnic South-African context, could be determined. As the Beery Developmental Test is quicker and easier to administer, this would contribute to the field of school readiness assessment. Dr. Lambrechts, head of the School Clinic in the Stellenbosch region, was consulted and this projected will be done in cooperation with the School Clinic. Written consent will also be obtained from the Western Cape Education Department.

Should you give consent, the children would be asked to complete a Beery Developmental Test and a Copying Test in March 2001. Each child's whole session would last approximately 20 minutes and would take place on the school premises. Be

ensured that **complete anonimity** is assured and no information that will be used for research purposes will be able to be related back to the childern in their personal capacity.

Feedback concerning the children will be given to the parents on request. In the case of possible developmental deficits, the parents will be contacted.

It will be highly appreciated if **arrangements** with regard to a first visit from the researcher prior to the test date in order to create rapport and other logistics could be finalised during a meeting, during which I will be happy to answer any questions you may have. I will contact you regarding the arrangements.

Your assistance in the above regard will be highly appreciated! May this experience be of benefit to you as well as the children.
Should you at any time wish to contact me, I may be reached at 082 782 3616.

I thank you in advance for your co-operation.
Yours sincerely

Munita Dunn
Intern in Counselling Psychology

Mrs. H.S. Loxton
Supervisor
Department of Psychology, University of Stellenbosch

ADDENDUM C

Pre-schools informative letter: Afrikaans

Ek doen tans navorsing om 'n Meestersgraad in Voorligtingsielkunde by die Universiteit van Stellenbosch te verwerf. Die studie handel oor die visueel-motoriese integrasie by voorskoolse kinders, m.a.w. kinders se vermoë om figure wat hulle sien, te onthou, en dit korrek weer te gee. Visueel-motoriese integrasie speel 'n belangrike rol in die ontwikkeling van die kind. Kinders wat hiermee ontwikkelingsagterstande ondervind, sal waarskynlik op skool probleme ondervind met die aanleer van lees-, skryf-, spel- en rekenkunde-vaardighede.

Twee meetinstrumente van visueel-motoriese integrasie wat algemeen in die praktyk gebruik word, word dikwels in die toetsbattery ingesluit. Die Suid-Afrikaanse **Natekentoets** is spesifiek vir Suid-Afrikaanse omstandighede ontwikkel, terwyl die **Beery-ontwikkelingstoets** vir Amerikaanse omstandighede ontwikkel is. Beide die toetse word dikwels tydens skoolgereedheidsassessering gebruik. Dr. Lambrechts, hoof van die Skoolkliniek op Stellenbosch, is reeds gekonsulteer en die projek sal in samewerking met die Skoolkliniek plaasvind. Geskrewe toestemming van die Wes-Kaap Onderwysdepartement sal ook verkry word.

Dit word in die vooruitsig gestel om beide hierdie toetse op 'n steekproef voorskoolse kinders toe te pas, sodat bepaal kan word of daar 'n beduidende ooreenstemming tussen die resultate is. Hierdeur kan vasgestel word of die Beery-ontwikkelingstoets geldige en betroubare resultate in 'n multi-kulturele Suid-Afrikaanse populasie lewer. Dit sal meer lig werp op die kontroversiële kwessie of dit sinvol is om die Beery in te sluit in Suid-Afrikaanse toetsbatterye. Aangesien die Beery vinniger en makliker is om af te neem, sal dit werklik 'n betekenisvolle bydrae tot skoolgereedheidsassessering maak.

Indien u toestemming verleen sal u kind gedurende Maart 2001 die Natekentoets en die Beery-ontwikkelingstoets by sy / haar kleuterskool aflê. Die toetstyd per kind sal ongeveer 20 minute duur. Wees egter verseker dat **volle vertroulikheid** gewaarborg word. Alle data word slegs vir navorsingsdoeleindes gebruik.

Terugvoer sal op aanvraag aan die ouers verleen word. Indien ontwikkelingsagterstande egter opgemerk word, sal u as ouers in kennis gestel word. Aanbevelings en praktiese riglyne sal ook verskaf word met betrekking tot hoe die kind gehelp kan word.

Indien **reëlings** aangaande 'n besoek aan u getref kan word, sal dit hoog op die prys gestel word. Die besoek voor die betrokke toetsdatum sal kennismaking behels asook 'n geleentheid skep waartydens al die logistieke probleme uitgeklaar kan word. Hiertydens sal enige vrae wat u mag hê, beantwoord word.

U samewerking in die verband sal waardeer word! Mag hierdie ervaring werklik van nut wees vir u asook die kinders.
Indien u my wil kontak, skakel gerus 082 782 3616.

Ek dank u by voorbaat vir u samewerking.
Vriendelike groete

Munita Dunn
Intern Voorligtingsielkundige

Me. H.S. Loxton
Supervisor
Departement Sielkunde, Universiteit van Stellenbosch

ADDENDUM D

Parents/guardians consent letter: English

(Adapted from Vorster, 1994)

Dear Parent / Guardian

I am currently doing research for my Master's Degree in Counselling Psychology at the University of Stellenbosch. The research is regarding the preschool child's visual-motor integration. Visual-motor integration plays an important role in the development of the child. This involves the effective working together of the eyes and muscles of the body and plays an important role in letter recognition, writing, copying figures and drawing. Visual-motor integration problems can have far-reaching consequences for the child's physical and psychological well-being and problems should therefore be detected as early as possible. Visual-motor integration is also an essential part of school readiness.

Two tests are widely used as screening techniques for visual-motor abilities – the Beery Developmental Test for Visual-Motor Integration developed for American circumstances and the South African Copying Test, developed by the Human Science Resource Council for South African children. Both tests are used regularly for the assessment of school readiness.

It is aimed to conduct both these tests with a sample of preschool children to determine whether there is a significant correlation between the results. By establishing this, the validity and reliability of the Beery Developmental Test for Visual-Motor Integration in a multi-ethnic South-African context, could be determined. As the Beery Developmental Test is quicker and easier to administer, this would contribute to the field of school readiness assessment. Dr. Lambrechts, head of the School Clinic in the Stellenbosch region, was consulted and this projected will be done in cooperation with the School Clinic. Written consent will also be obtained from the Western Cape Education Department.

Should you give consent, your child would be asked to complete a Beery Developmental Test and a Copying Test in March 2001. The whole session would last approximately 20

minutes and would take place on the school premises. Be ensured that complete anonimity is assured and no information that will be used for research purposes will be able to be related back to your child in his / her personal capacity.

Arrangements for the specific day will be made with your child's teacher

Ms..... of ..... pre-primary.

Feedback concerning your child will be given on request. In the case of possible developmental deficits, the parents will be contacted. Recommendations and practical guidelines will be given to help your child.

Please be so kind as to fill in the attached form, and return it to the preprimary teacher before 7 March 2001.

Should you at any time wish to contact me, I may be reached at 082 782 3616.
I thank you in advance for your co-operation.

Yours sincerely

Munita Dunn
Intern in Counselling Psychology

Mrs. H.S. Loxton
Supervisor
Department of Pscyhology, University of Stellenbosch

Please be so kind as to fill in the attached form, and return it to the preprimary teacher before 7 March 2001.

Hereby I give consent that (full names and surname) ..... may participate in the research project regarding visual-motor integration.

Yes	1	No	2

I would like to receive feedback concerning the test results.

Yes	1	No	2

Parent's full name and surname in block letters : .....

Signature : ..... Date : .....

ADDENDUM E
Parents/guardians consent letter: Afrikaans
(Adapted from Vorster, 1994)

Geagte Ouer / Voog

Ek doen tans navorsing om 'n Meestersgraad in Voorligtingsielkunde by die Universiteit van Stellenbosch te verwerf. Die studie handel oor die visueel-motoriese integrasie by voorskoolse kinders, m.a.w. kinders se vermoë om figure wat hulle sien, te onthou, en dit korrek weer te gee. Visueel-motoriese integrasie speel 'n belangrike rol in die ontwikkeling van die kind. Kinders wat hiermee ontwikkelingsagterstande ondervind, sal waarskynlik op skool probleme ondervind met die aanleer van lees-, skryf-, spel- en rekenkunde-vaardighede.

Twee meetinstrumente van visueel-motoriese integrasie wat algemeen in die praktyk gebruik word, word dikwels in die toetsbattery ingesluit. Die Suid-Afrikaanse Natekentoets is deur die RGN ontwikkel, spesifiek vir Suid-Afrikaanse omstandighede, terwyl die Beery-ontwikkelingstoets vir Amerikaanse omstandighede ontwikkel is. Beide die toetse word dikwels tydens skoolgereedheidsassessering gebruik. Dr. Lambrechts, hoof van die Skoolkliniek op Stellenbosch, is reeds gekonsulteer en die projek sal in samewerking met die Skoolkliniek plaasvind. Geskrewe toestemming van die Wes-Kaap Onderwysdepartement sal ook verkry word.

Dit word in die vooruitsig gestel om beide hierdie toetse op 'n steekproef voorskoolse kinders toe te pas, sodat bepaal kan word of daar 'n beduidende ooreenstemming tussen die resultate is. Op hierdie manier kan vasgestel word of die Beery-ontwikkelingstoets geldige en betroubare resultate in 'n multi-kulturele Suid-Afrikaanse populasie lewer. Dit sal meer lig werp op die kontroversiële kwessie of dit sinvol is om die Beery in te sluit in Suid-Afrikaanse toetsbatterye. Aangesien die Beery vinniger en makliker is om af te neem, sal dit werklik 'n betekenisvolle bydrae tot skoolgereedheidsassessering maak.

Indien u toestemming verleen sal u kind gedurende Maart of April 2000 die Natekentoets en die Beery-ontwikkelingstoets by sy / haar kleuterskool aflê. Die toetstyd per kind sal ongeveer 20 minute duur. Wees egter verseker dat volle vertroulikheid gewaarborg word. Alle data word slegs vir navorsingsdoeleindes gebruik.

Die reëlings aangaande die toetsing sal getref word met u kind se onderwyseres :

Me ..... van .....kleuterskool

Terugvoer sal op aanvraag aan u as ouers verleen word. Indien ontwikkelingsagterstande egter opgemerk word, sal u as ouers in kennis gestel word. Aanbevelings en praktiese riglyne sal ook verskaf word met betrekking tot hoe die kind gehelp kan word.

U toestemming om u kind aan die projek te laat deelneem, sal waardeer word! Vul asseblief die onderstaande strokie in en besorg dit terug by die onderwyseres voor 5 Maart 2001.

Indien u enige verdere inligting verlang, is u welkom om my te kontak by 082 782 3616. Baie dankie vir u samewerking!

Vriendelike groete

Munita Dunn
Intern Voorligtingsielkundige

Mev. H.S. Loxton
Studieleier
Sielkunde Departement, Universiteit van Stellenbosch

Wees asseblief so gaaf om die onderstaande in te vul en aan die onderwyseres terug te besorg voor 5 Maart 2001.

Hiermee verleen ek toestemming dat (volle name en van) ..... aan die navorsingsprojek oor visueel-motoriese integrasie mag deelneem.

Ja	1	Nee	2

Ek wil graag terugvoer oor die toetsresultate hê.

Ja	1	Nee	2

Ouer se volle naam en van in drukskrif : .....

Handtekening : ..... Datum : .....

ADDENDUM F

Parents/guardians consent letter: Xhosa

KwiYunivesithi yase-Stellenbosch, kukho uphando oluqhutywayo kubantwana abalungele ukungena esikolweni ngokuphathelele kwindlela ababona ngayo. Le nto ibandakanya ukusetyenziswa ngaxeshanye kwamehlo nemisipha yomzimba, kwaye le nto idlala indima ebalulekileyo ekwazini, ekubhaleni nasekuzobeni. Ukubandakanya ukusetyenziswa kokubona yeyona nto ibalulekileyo xa ulungiselela ukungena esikolweni.

Ulwazi olufumaneke kolu phando luya kujolisa ekwazini ngcono nasekuncedeni, ukuba kuyimfuneko, abantwana abakwiminyaka emihlanu nemithandathu. Injongo yokugqibela kukusebenzisa olu lwazi ukuze kuncedakale abanye abantwana emZantsi Afrika.

Ukuza kuma apha, le yincwadi yobuhlobo, ecela kuni njengabazali bomntwana oneminyaka efunwayo kwesi sifundo, nivumele umntwana wenu ukuba athabathe inxaxheba kule nkqubo yophando. Kuqinisekiswa imfihlo kwaye akukho nkcazelo iya kusetyenziselwa iimfuno zophando neya kuthi ibandakanye unmtwana wakho buqu. Ekuchazeni iziphumo zophando, abantwana baya kubizwa ngokwesini neminyaka.

Ukuba unika imvume, umntwana uya kucelwa ukuba abhale uvavanyo kabini. Iseshoni yakhe ayisayi kuthatha ngaphezu kweyure, kwaye iya kwenziwa ngexesha lesikolo esikolweni.

Amalungiselelo olu suku aya kwenziwa no:

Nksz.....wase.....pre-primary.

Uyacelwa ukuba ungathethi nto nomntwana ngokuphathelele kuphando phambi komhla wophando. Ukuba unomdla, kungenziwa iziphumo zeqela ngexesha lokunika inkcazelo. Intsebenziswano yakho kule nto ingentla iya kuthakazelelwa kwaye kuyathenjwa ukuba ukuthabatha kwakho inxaxheba kolu phando kuya kuba luncedo kuwe nakubantwana.

Uyacelwa ukuba uzalise le fomu uze uyibuyisele kutitshala wase 'pre-primary' phambi komhla we 12 March 2001. Ukuba ufuna ukudibana nam nangaliphi na ixesha, ungandifumana kule nombolo yomnxeba 082 782 3616.

Ndiyakubulela ngentsebenziswano yakho.
Ozithobileyo.

Munita Dunn
Intern in Counselling Psychology

Mrs. H.S. Loxton
Supervisor

Department of Pscyhology, University of Stellenbosch

Uyacelwa ukuba uzalise le fomu uze uyibuyisele kutitshala wase 'pre-primary' phambi komhla we 12 March 2001.

✂.....

Ndinika imvume yokuba (amagama apheleleyo kune nefani) ..... anganthatha inxaxheba kuphando oluphathelelene nendlela yokubona kunye nokusetyenziswa kwemisipha yomzimba.

Ewe	1	Hayi	2

Ndingathanda ukufumana ingxelo ngokuphathelele kwiziphumo.

Ewe	1	Hayi	2

Sayina : ..... Usuku : .....

ADDENDUM G

Parents biographical questionnaire: English

(As used in Vorster, 1994)

1. **Name of child** : .....

2. **Address** : .....
   .....**Telephone number** : .....

3. **Sex** :

Male	1	Female	2

4. **Date of birth** : Year ..... Month .....Day.....

5. **Age in months** : .....

6. **Home language** :

Afrikaans	1
English	2
Both Afrikaans and English	3
Other	4

If "other", please specify : .....

7. **Current marital status of parents** :

Married (Legally)	1
Married (Seremonially)	2
Never married	3
Widow / Widower	4
Divorced	5
Living together	6
Separated	7

If parents are not living together, with which parent is the child staying? .....

8. **Mother's highest educational qualifications** :

Std 5 or lower	1
Std 6 or 7 / Equivalent qualification	2
Std 8 or 9 / Equivalent qualification	3
Std 10 / Equivalent qualification	4
Std 10 and 1 or 2 years further training	5
Std 10 and 3 or more years further training	6

9. **Father's highest educational qualifications** :

Std 5 or lower	1
Std 6 or 7 / Equivalent qualification	2
Std 8 or 9 / Equivalent qualification	3
Std 10 / Equivalent qualification	4
Std 10 and 1 or 2 years further training	5
Std 10 and 3 or more years further training	6

10. **Occupation of Mother** :

Professional	1	Half-schooled / Not schooled	7
Administrative	2	Housewife	8
Salesperson	3	Student	9
Apprenticeship	4	Unemployed	10
Working outside	5	Other	11
Farmer	6		

If "other", please specify : .....

11. **Occupation of Father** :

Professional	1	Half-schooled / Not schooled	7
Administrative	2	Housewife	8
Salesperson	3	Student	9
Apprenticeship	4	Unemployed	10
Working outside	5	Other	11
Farmer	6		

If "other", please specify : .....

12. Please evaluate the child according to the following aspects as a score of 1 represents "very weak" and a score of 7 "excellent" :

a. Level of school readiness	1	2	3	4	5	6	7
b. Ability to learn reading	1	2	3	4	5	6	7
c. Ability to learn arithmetic	1	2	3	4	5	6	7
d. Ability to learn writing	1	2	3	4	5	6	7
e. Level of fine motor competency	1	2	3	4	5	6	7
f. Ability to concentrate	1	2	3	4	5	6	7

13. **Developmental history of the child** :

a) Any problems during pregnancy?

Yes	1	No	2

If "yes", please specify : .....
.....

b) Problems during birth?

Yes	1	No	2

If "yes", please specify : .....
.....

c) Problems after birth?

Yes	1	No	2

If "yes", please specify : .....
.....

d) Apgar score :

Normal	1	Abnormal	2	Not available	3

e) Has your child ever had any illness with neurological implications – for example Encephalitis?

Yes	1	No	2

If "yes", please specify : .....
.....

f) Has your child ever experienced a severe head or back injury?

Yes	1	No	2

If "yes", please specify : .....
.....

14. Has your child had an assessment for school readiness?

Yes	1	No	2

If "yes", please specify : .....
.....

Thank you for your co-operation! All the above information will be treated as strictly confidential.

ADDENDUM H

Parents biographical questionnaire: Afrikaans

(As used in Vorster, 1994)

1. **Naam van kind** : .....

2. **Adres** : .....
.....**Telefoonnommer** : .....

3. **Geslag** :

Manlik	1	Vroulik	2

4. **Geboortedatum** : Jaar .....Maand.....Dag.....

5. **Ouderdom in maande** : .....

6. **Huistaal** :

Afrikaans	1
Engels	2
Beide Afrikaans en Engels	3
Other	4

Indien "ander", spesifiseer asseblief : .....

7. **Huidige huwelikstaat van ouers** :

Getroud (Wetlik)	1
Getroud (Seremonieel)	2
Nooit getroud	3
Weduwee / Wewenaar	4
Geskei	5
Leef saam	6
Vervreem	7

Indien ouers nie saamwoon nie, by watter ouer is die kind tans woonagtig?.....

8. **Moeder se hoogste opvoedkundige kwalifikasie** :

St 5 of laer	1
St 6 of 7 / Ewivalente kwalifikasie	2
St 8 of 9 / Ekwivalente kwalifikasie	3
St 10 / Ekwivalente kwalifikasie	4
St 10 en 1 of 2 jaar verdere opleiding	5
St 10 en 3 of meer jaar verdere opleiding	6

9. Vader se hoogste opvoedkundige kwalifikasie :

St 5 of laer	1
St 6 of 7 / Ewivalente kwalifikasie	2
St 8 of 9 / Ekwivalente kwalifikasie	3
St 10 / Ekwivalente kwalifikasie	4
St 10 en 1 of 2 jaar verdere opleiding	5
St 10 en 3 of meer jaar verdere opleiding	6

10. Moeder se beroep :

Professioneel	1	Half- en ongeskoold	7
Administratief	2	Huisvrou	8
Verkoopswerkster	3	Student	9
Ambagsopleiding	4	Werkloos	10
Buitewerkster	5	Ander	11
Boer	6		

Indien "ander", spesifiseer asseblief : .....

11. Vader se beroep :

Professioneel	1	Half- en ongeskoold	7
Administratief	2	Huisvrou	8
Verkoopswerkster	3	Student	9
Ambagsopleiding	4	Werkloos	10
Buitewerkster	5	Ander	11
Boer	6		

Indien "ander", spesifiseer asseblief : .....

12. Beoordeel asseblief die kind ten opsigte van die volgende aspekte (Skaalpunt 1 beteken "besonder swak" terwyl skaalpunt 7 "uitstekend" beteken):

a. Algemene vlak van skoolgereedheid | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

b. Vermoë om te leer lees | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

c. Vermoë om rekeningkunde te leer | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

d. Vermoë om skrif te leer | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

e. Vlak van fynmotoriese vaardigheid | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

f. Vermoë om te konsentreer | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

13. Ontwikkelingsgeskiedenis van die kind :

a) Enige swangerskapprobleme?

Ja	1	Nee	2

Indien "ja", spesifiseer asseblief :.....
.....

b) Probleme tydens geboorte?

Ja	1	Nee	2

Indien "ja", spesifiseer asseblief :.....
.....

c) Probleme net na geboorte?

Ja	1	Nee	2

Indien "ja", spesifiseer asseblief :.....
.....

d) Apgartelling :

Normaal	1	Abnormaal	2	Nie beskikbaar	3

e) Het die kind al enige siektes met neurologiese implikasies (soos bv. enkefalitis) gehad?

Ja	1	Nee	2

Indien "ja", spesifiseer asseblief :.....
.....

f) Was die kind al in enige ongelukke betrokke waar hy / sy kop- of rugbeserings kon opgedoen het?

Ja	1	Nee	2

Indien "ja", spesifiseer asseblief :.....
.....

14. Het die kind al 'n skoolgereedheidsevaluering ondergaan?

Ja	1	Nee	2

Indien "ja", spesifiseer asseblief :.....
.....

Dankie vir u samewerking! Alle inligting sal as streng vertroulik hanteer word.

ADDENDUM I
Parents biographical questionnaire: Xhosa

1. **Igama lomntwana** : .....

2. **Idilesi** : .....
.....**Ifoni** : .....

3. **Isini** :

Indoda	1	Umfazi	2

4. **Umhla wokuzalwa** : Umnyaka ..... Inyanga..... Usuku.....

5. **Ubudala ngeenyanga** : .....

6. **Ulwimi oluthethwa ekhaya** :

IsiBhulu	1
IsiNgesi	2
IsiXhosa	3
Olunye	4

Ukuba uthi 'olunye', nceda uchaze : .....

7. **Isimo somtshato sabazali** :

Batshatile (ngokusemthethweni)	1
Batshatile	2
Zange batshate	3
Ngumhlolo / mhlolokazi	4
Baqhawulile	5
Bayahlalisana	6
Bohlukene	7

Ukuba abazali abahlali kunye, ingaba umntwana uhlala nowuphi umzali?.....

8. Imfundo kamama :

Ibanga le 5 okanye ngaphantsi	1
Ibanga le 6 okanye le 7 / imfundo elingana nale	2
Ibanga le 8 okanye le 9 / imfundo elingana nale	3
Ibanga le 10 okanye imfundo elingana nale	4
Ibanga le 10 kunye noqeqesho lonyaka okanye emibini	5
Ibanga le 10 kunye noqeqesho leminyaka emithathu nangaphezulu	6

9. Imfundo katata :

Ibanga le 5 okanye ngaphantsi	1
Ibanga le 6 okanye le 7 / imfundo elingana nale	2
Ibanga le 8 okanye le 9 / imfundo elingana nale	3
Ibanga le 10 okanye imfundo elingana nale	4
Ibanga le 10 kunye noqeqesho lonyaka okanye emibini	5
Ibanga le 10 kunye noqeqesho leminyaka emithathu nangaphezulu	6

10. Umsebenzi kamama :

Uqeshiwe	1	Akagqibanga ukufunda / akafundanga	7
Usezi-ofisini	2	Uhlala ekhaya	8
Uyathengisa	3	Uyafunda	9
Ngumfundi	4	Akasebenzi	10
Usebenza ngaphandle	5	Okunye	11
Ngumlimi	6		

Ukuba uthi 'okunye', nceda uchaze : .....

11. Umsebenzi katata :

Uqeshiwe	1	Akagqibanga ukufunda / akafundanga	7
Usezi-ofisini	2	Uhlala ekhaya	8
Uyathengisa	3	Uyafunda	9
Ngumfundi	4	Akasebenzi	10
Usebenza ngaphandle	5	Okunye	11
Ngumlimi	6		

Ukuba uthi 'okunye', nceda uchaze :.....

12. Nceda uhlole umntwana wakho ngokwale miba ilandelayo, inqaku elingi-1 lithetha 'buthathaka', yaye inqaku elingu 7 lithetha 'emagqabini' :

a. Ukulungele ukungena esikolweni	1	2	3	4	5	6	7
b. Angakwazi ukufunda	1	2	3	4	5	6	7
c. Angakwazi ukufunda amanani	1	2	3	4	5	6	7
d. Angakwazi ukufunda ukubhala	1	2	3	4	5	6	7
e. Izinga lokusebenzisa amalungu omzimba	1	2	3	4	5	6	7
f. Angakwazi ukuphulaphula	1	2	3	4	5	6	7

13. Imbali ngokukhula komntwana :

a) Ingaba bezikhona na iingxaki ngexesha lokukhulelwa?

Ewe	1	Hayi	2

Ukuba uthi 'ewe', nceda uchaze :

.....

.....

b) Iingxaki ngexesha lokuzalwa?

Ewe	1	Hayi	2

Ukuba uthi 'ewe', nceda uchaze :

.....

.....

c) Iingxaki emva kokuzalwa?

Ewe	1	Hayi	2

Ukuba uthi 'ewe', nceda uchaze :

.....

.....

d) Inqaku leApga :

Phililе	1	Ayiphilanga	2	Ayifumaneki	3

g) Ingaba umntwana wakho ukhe wanaso isigulo ngokuphathelele kwimithambo-luvo, umzekelo ukukrala kobuchopho?

Ewe	1	Hayi	2

Ukuba uthi 'ewe', nceda uchaze :

.....

.....

h) Ingaba umntwana wakho ukhe wanazo iintlungu zentloko okanye ezomzimba?

Ewe	1	Hayi	2

Ukuba uthi 'ewe', nceda uchaze :

.....

.....

14. Ingaba umntwana wakho ukhe wahlolwa ukuba ukulungele ukungena esikolweni?

Ewe	1	Hayi	2

Ukuba uthi 'ewe', nceda uchaze :

.....

.....

Enkosi ngentsebeziswano yakho! Yonke inkcazelo efumaneke apha iya kuthatyathwa njengeyimfihlelo.

ADDENDUM J

Rating by the teacher

(As used in Vorster, 1994)

Name : .....

Preprimary : .....

Teacher : .....

Date : .....

Please evaluate the child regarding the following aspects whereby a score of 1 is 'very weak' and a score of 7 is 'excellent'. Just circle the accurate score.

1. Overall level of school readiness	1	2	3	4	5	6	7
2. Ability to learn reading	1	2	3	4	5	6	7
3. Ability to learn arithmetic	1	2	3	4	5	6	7
4. Ability to learn writing	1	2	3	4	5	6	7
5. Level of fine motor competencies	1	2	3	4	5	6	7
6. Ability to concentrate	1	2	3	4	5	6	7

ADDENDUM K

Standardised test instructions: English

VMI (Beery, 1989, 1997)

- Distribute the test booklets and say : *Please do not open your booklets until I ask you to do so.*
- After distribution, say : *The page with the hand pointing up should face you.*
- As you demonstrate, say : *Now open your booklet by turning from the top, like this.*
- It is important that the booklets and each child's body be centred and squared with the desks throughout the testing. As you demonstrate, say : *This is the way your booklet must stay on you desk until you are finished. This is the way you are to sit.*
- Demonstrate on the board how to copy the forms, but do not use any of the test forms. Design your own, say : *You are to copy what you see at the top of each page. Make your drawing of each shape in the space below it, like this.*
- Say : *The shapes are to be copied in order, starting with number 1. Only one try on each shape is allowed, and you cannot erase.*
- Say : *Some of the shapes are very easy, and some are very hard even for adults to do. But please try to copy all of them.*
- Say : *Do your best on both the easy and the hard ones.*

THE COPYING TEST (Madge, 1981b)

- Say : *Now you can make me some drawings with this pencil. I am going to show you a card with a drawing on it and you must try to make a drawing just like it on the paper I will give to you.*
- Present item 1 and place a blank sheet of paper directly below it in front of the testee.
- *Now draw one just like this* (show) *here* (point to the blank sheet of paper but be careful not to point to a specific spot). *Make the best drawing you can.*

ADDENDUM L

Standardised test instructions: Afrikaans

VMI (Beery, 1989, 1997)

- Moet asseblief nie die toetsboekie oopmaak voor ek sê jy mag nie.
- Maak nou jou boekie oop soos ek vir jou wys (demonstreer).
- Jy moet teken wat jy bo-aan elke bladsy sien. Maak jou tekening van elke vorm in die spasie onder die vorm.
- Die vorms moet in dieselfde volgorde geteken word. Begin by die eerste een. Jy mag net een keer probeer en jy mag nie uitvee nie.
- Party vorms is makliker, maar party is baie moeilik, selfs vir grootmense. Probeer asseblief om almal te teken.
- Probeer jou beste op die maklike en moeilike vorms.

THE COPYING TEST (Madge, 1981b)

- Nou kan jy 'n paar tekeninge maak met hierdie potlood. Ek gaan vir jou 'n kaartjie wys met 'n tekening daarop en jy moet probeer om dit presies net so te teken op die papier wat ek vir jou gee.
- (Lê item 1 voor en plaas 'n blanke stuk papier direk aan die onderkant daarvan voor die toetsling).
- Teken nou een net soos hierdie (wys na item 1). Probeer jou bes en teken net so mooi as wat jy kan.

ADDENDUM M

Standardised test instructions: Xhosa

VMI (Beery, 1989, 1997)

- Ncedani nilinde phambi kokuba niqale de nixelelwe ukuba qalani. Ze ningazivuli incwadana zenu zemvavanyo ndide ndinixelele ukuba nizivule.
- Amaxwebu makakhutshelwe ngokulandelana kawo. Ixwebhu ngalinye maligcwaliswe kube kanye.
- Khuphelani okanye kopani loo nto eniyibonayo emantla ephepha. Imizobo yenu yenzeni kwisithuba esingaphantsi kwizimo enizizobileyo.
- Amanye amaxwebhu anganithwalisa ubunzima xa niwakhuphela, kodwa ke zamani ukuwakhuphela wonke. Zamani ukuwenza wonke kangangoko ninako ngaphandle kokucima.

THE COPYING TEST (Madge, 1981b)

- Ncedani nilinde phambi kokuba niqale de nixelelwe ukuba qalani.
- Amaxwebu makakhutshelwe ngokulandelana kawo. Ixwebhu ngalinye maligcwaliswe kube kanye.
- Amanye amaxwebhu anganithwalisa ubunzima xa niwakhuphela, kodwa ke zamani ukuwakhuphela wonke.
- Umntu ngamanye makazenzele umsebenzi wakhe.

ADDENDUM N

Feedback to parent/guardian: English

Dear Parent/Guardian

Thank you that ..... could participate in my research regarding visual motor integration during March and April 2001. I would like to give you feedback concerning the results.

Your child completed the Beery Developmental test as well as the South African Copying test. Both these tests are widely used as screening techniques for visual motor abilities. Visual motor integration involves the effective working together of the eyes and the muscles of the body and plays an important role in letter recognition, writing, copying figures and drawing. Visual motor integration is an essential part of school readiness.

The chronological age of your child was ..... years and ..... months during the assessment.

Your child

a) performed according to his / her chronological age,
b) performed slightly above his / her chronological age,
c) performed significantly above his / her chronological age,
d) performed slightly below his / her chronological age,
e) could benefit from a comprehensive assessment,
f) showed problems regarding his / her visual abilities and could benefit from an assessment by an optometrist.

Attention has been given to the deficits and the teachers received a program with activities aiming to enhance visual motor integration. If you have any further enquiries, please feel welcome to phone me at 082 782 3616 or (021) 808 4707 (office hours). The School Clinic may also be contacted at (021) 887 0222.

Thank you for the privilege to test your child!

Munita Dunn

Intern in Counselling Psychology

ADDENDUM O

Feedback to parent/guardian: Afrikaans

Geagte Ouer / Voog

Baie dankie dat ..... in Maart en April 2001 aan my navorsing oor visueel-motoriese integrasie kon deelneem. Ek wil graag vir u terugvoer in verband hiermee verskaf.

U kind het die Beery-ontwikkelingstoets en die Suid-Afrikaanse Natekentoets afgelê. Beide toetse meet visueel-motoriese integrasie – met ander woorde, die kind se vermoë om dit wat hy sien, te onthou en weer te teken.

Die chronologiese ouderdom van u kind was ..... jaar en ..... maande tydens toetsing.

U kind

a) het volgens chronologiese ouderdom presteer,
b) het effens bo chronologiese ouderdom presteer,
c) het beduidend bo chronologiese ouderdom presteer,
d) het effens onder chronologiese ouderdom presteer,
e) kan baat indien hy / sy vir 'n volledige assessering verwys word,
f) het visuele uitvalle getoon en kan baat by 'n optometriese evaluering.

Daar is aandag aan die uitvalle gegee en leiding is aan die onderwyseres gegee met betrekking tot 'n program vir die oefening van visueel-motoriese integrasie. Indien u enige verdere navrae het, is u welkom om my te skakel by 082 782 3616 of (021) 808 4707 (kantoor-ure), of ook die Skoolkliniek by (021) 887 0222.

Baie dankie vir die voorreg om u kind te kon toets!

Vriendelike groete

Munita Dunn

Intern-Voorligtingsielkundige

ADDENDUM P

Feedback to parent/guardian: Xhosa

Mzali obekekileyo,

Ndiyayibulela into yokuba u..... athathe inxaxheba kuphando lwam ngokuphathelele kwindlela amalungu omzimba asebenza ngayo ngexesha lika Matshi no Apreli 2001. Ndingathanda ukuba ndikunike ingxelo ngokuphathelele kwiziphumo.

Umntwana wakho ugqibe uvavanyo olubizwa ngokuba yi-Beery Developmental kunye nolo lubizwa ngokuba yi-South African Copying. Zombini ezi ndlela zovavanyo zisetyenziswe ngokubanzi ekufumaneni iindlela umntu abona ngazo. Indlela umntu abona ngayo ibandakanya ukusebenzisa ngaxeshanye amehlo kunye nemisipha yomzimba kwaye idlala indima ebalulekileyo ekwazini amagama, ekubhaleni, ekukhupheleni amanani nasekuzobeni. Indlela umntu abona ngayo yeyona ndima ibalulekileyo ekujongeni ukuba umntwana ukulungele ukungena esikolweni kusini na.

Umntwana wakho ebeneminyaka e..... neenyanga ezi .....ngexesha ebevavanywa. Umntu wakho

a) wenze ngokulungele iminyaka yakhe,
b) wenze kancinci ngaphezu kokulindeleke kwiminyaka yakhe,
c) wenze ngaphezu kokulindeleke kwiminyaka yakhe,
d) wenze kancinci ngaphantsi kokulindeleke kwiminyaka yakhe,
e) angazuza ngokuthi rhoqo aphononongwe,
f) ubonakalise iingxaki kwindlela abona ngayo kwaye angazuza ngokuthi avavanywe ngugqirha wamehlo.

Kuye kwathatyathwa ingqalelo kwizinto ezisileleyo kwaye ootitshala bafumene inkqubo yemeisebenzi enokwenziwa ukuze kuphuculwe izinga umntu abona ngalo.

Ukuba uneminye imibuzo, wamkelekile ukuba ungandifowunela kule nombolo 082 782 3616 okanye (021) 808 4707 (ngexesha lomsebenzi). Yona ikliniki yesikolo kungadityanwa nayo kule nombolo (021) 887 0222.

Enkosi ngokundivumela ndivavanye umntwana wakho!

Munita Dunn
Intern in Counselling Psychology